

Issuance Transmittal Sheet

NASA

National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

ISSUANCE NUMBER: MM 8040.12B, Change 1	DATE: September 25, 1995
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Material Transmitted:

1. Marshall Manual 8040.12B, Change 1, Subject: "Standard Contractor Configuration Management Requirements, MSFC Programs"
2. This manual has been changed to incorporate the following updates and corrections:
 - a. Page 11: Item (9) in column 2 was inadvertently omitted from Table 1, "Class I Change Definition".
 - b. Make pen and ink change on Page II-8, paragraph 3.4.4.2 heading: Change "Date" to "Data". Heading should read "SCI Required Data Elements".
 - c. Make pen and ink change on Page III-5, item 10: change "ECR" to "ECP".
 - d. Page V-27, paragraph 40.1: Blocks and Instructions have been corrected to correspond with block numbers on Form 4240, "Project Change Proposal".

(Signed by)

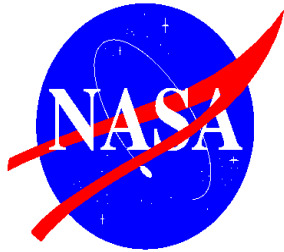
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SDL-2

Filing Instructions:

Make pen and ink changes.
Replace Page 11 with the attached Page 11.
Replace Pages V-27 and V-28 with the attached Pages V-27 and V-28.
File this transmittal sheet in front of MM 8040.12B.

MSFC Form 1376 (Rev. October 1994)



MM 8040.12B
MARCH 17, 1995

STANDARD CONTRACTOR CONFIGURATION MANAGEMENT REQUIREMENTS, MSFC PROGRAMS

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PREFACE

This manual provides the configuration management (CM) requirements for control of the design, development, integration, operation, and logistical support necessary to meet the requirements of NASA programs and projects. Compliance with these requirements will assure compatibility of the contractor's internal CM system with the system used by MSFC.

Contractors shall implement the requirements of this Manual to the extent specified in the contract.

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SDL 2

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STANDARD CONTRACTOR CONFIGURATION MANAGEMENT
REQUIREMENTS, MSFC PROGRAMS1.0 GENERAL1.1 Purpose

The purpose of this manual is to establish requirements for implementing configuration management (CM) on contracts to design, develop, fabricate, integrate, operate, or provide logistical support to hardware, software, and firmware items and services being procured by MSFC.

1.2 Applicability

This manual is applicable to all MSFC contractors performing design, development, fabrication, integration, operations or logistical products and services for MSFC programs or projects. Changes made by this document revision are not intended for retroactive application, but will be imposed on all new contracts (to the extent specified in the contract) and may be incorporated into existing contracts.

1.3 Applicable Documents

The following documents of the issue in effect on the date of incorporation of these requirements form a part of this document to the extent specified herein.

1.3.1 MSFC Documents

MSFC-MNL-2348	"Specifications and Standards Approved Baseline List"	Exhibit II, 10.3.3
MM 8075.1	"Software Management and Development Requirements Manual"	Exhibit II, Table II-1; Exhibit VIII, 3.3

1.3.2 Military Documents

MIL-STD-100	"Engineering Drawing Practices"	Basic portion, 2.5; Exhibit I, 3.5.2; Exhibit III, 3.3; Exhibit IV, 3.2.2.1, 3.2.2.2, 3.2.2.2.a., and 3.2.4
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MIL-STD-130	"Identification Marking of US Military Property"	Exhibit IV, 3.2.5.3
MIL-STD-490	"Specification Practices"	Exhibit II, 3.0, Table II-1, Table II-2, 10.3.1.7, 20.7, 30.7, 40.5, 40.6, and Exhibit IV, 3.2.1.1
MIL-STD-970	"Standards and Specifications, Order of Preference for the Selection of"	Exhibit II, 10.3.3
MIL-STD-973	"Configuration Management"	Exhibit XII, 3.3a., b., and c.
MIL-T-31000	"Technical Data Packages, General Specification For"	Basic portion, 2.5

1.3.3 Federal Documents

Cataloging Handbook H4/H8	"Commercial and Government Entity (CAGE) Codes"	Exhibit II, Table II-1, Exhibit IV, 3.2.7, Exhibit V, 3.1.8.3, 40.1, and Exhibit XII, 3.5
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1.3.4 Industrial Standards

ASME Y14.24	"Types and Applications of Engineering Drawings"	Exhibit III, 3.1.1 a.
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1.4 Definitions, Abbreviations, and Acronyms

For the definition of terms and a list of abbreviations and acronyms used in this document, see Exhibit XII.

1.5 Policy

1.5.1 General

The contractor shall establish a CM program covering the appropriate life cycle phases of the applicable contract

end items (CEI's) and computer software configuration items (CSCI's). In this document, CEI and CSCI are used synonymously. The requirements of this manual shall be implemented and tailored as stated in the contract statement of work (SOW) and consist of the following elements:

- a. Configuration identification
- b. Configuration control
- c. Configuration accounting
- d. Configuration verification; configuration verification/validation for software/firmware

The contractor shall assure compliance with the requirements of this CM program by all appropriate subcontractors.

1.5.2 Configuration Management Planning

1.5.2.1 General

The contractor shall plan a CM program in accordance with the requirements of this manual. The CM program shall be tailored appropriately for the particular CEI(s), their scope and complexity, and the contracted phase(s) of the life cycle.

1.5.2.2 Contractor's CM Plan

The contractor shall develop a CM plan that describes the processes, methods, and procedures to be used to manage the functional and physical characteristics of the CEI(s). The CM plan, when approved, will form the basis for implementation of CM requirements and shall be maintained by the contractor. The content and format of the CM plan shall be in accordance with Exhibit I and as tailored by the contract SOW. The contractor shall submit the CM plan and changes thereto in accordance with the contract data procurement document (DPD).

2.0 CONFIGURATION IDENTIFICATION

2.1 General

Configuration identification is the process by which the requirements for and configuration of all items are defined.

2.1.1 Configuration Identification Baselines

The contractor shall accomplish configuration identification through development of formal documentation that defines the baseline being established and provides for the control and accounting of future changes to that baseline.

2.1.2 Implementation

The contractor shall implement configuration identification for every CEI.

2.2 Baseline Identification

2.2.1 General

The contractor shall use a series of design reviews to establish the successive configuration baselines and to provide subsequent configuration control. The baselines used by MSFC are the Mission Baseline, the Design Requirements Baseline, and the Product Baseline. These baselines and appropriate requirements are discussed in the following paragraphs.

2.2.2 Mission Baseline Identification

The contractor shall either develop the Mission Baseline or satisfy the requirements contained in a baseline imposed by the contract. The Mission Baseline will identify program/project performance requirements in the form of a system(s) specification or equivalent and associated Interface Requirements Documents (IRD's), if required. The Mission Baseline is established upon successful completion of the Program Requirements Review (PRR). The Mission Baseline documentation shall be updated and shall serve throughout the CEI life cycle as a description and identification of program/project requirements.

2.2.3 Design Requirements Baseline Identification

The contractor shall develop and document the Design Requirements Baseline to identify design and development requirements allocated to a CEI from the Mission Baseline. The contractor shall develop and progressively document the Design Requirements Baseline and formally submit baseline documentation prior to the Preliminary Design Review (PDR). The documentation required for a Design Requirements Baseline shall include Part I hardware specifications, software requirements specifications or equivalent, and associated Interface Control Documents (ICD's).

2.2.4 Contractor Internal Baseline Controls

The contractor shall establish internal release and control of drawings and detail specifications. Control of drawing changes shall be exercised during building and testing of qualification hardware prior to submittal of the Part II CEI specifications and drawings for Configuration Inspection (CI) and establishment of the Product Baseline.

2.2.5 Product Baseline Identification

The contractor shall document and identify the Product Baseline in the Part II hardware specification(s), software product specification(s), and drawings based upon successful completion of the CI. The Product Baseline establishes the approved documentation describing all of the necessary functional and physical characteristics of the CEI, the selected functional and physical characteristics designated for production acceptance testing, and tests necessary for support. The Product Baseline phase extends from the start of production through operation.

2.3 Specification Identification

All contracts for development or production shall utilize specifications for identification of hardware and software CEI's. The contractor shall prepare specifications for configuration identification in accordance with appropriate contract requirements. Detailed requirements associated with specification types, formats, and minimum contents are contained in Exhibit II.

2.4 Interface Identification

The contractor shall comply with imposed interface requirements and shall establish interface identification documentation as required by contract provisions and systems integration considerations. These interface identifications shall become a portion of the Mission Baseline and the Design Requirements Baseline. Interface documentation consists of ICD's and/or IRD's. The contractor shall establish baselines and control interfaces in accordance with the requirements contained in Exhibit III.

2.4.1 Interface Requirements Documents

The contractor shall comply with and/or develop IRD's as required by the contract SOW requirements. The IRD will define interface requirements to be controlled between

programs, projects, systems, or CEI's. The specifications for the interfacing elements shall reference and identify applicable IRD's.

2.4.2 Interface Control Documents

ICD's are the design solutions to the IRD's. In accordance with contract SOW requirements, the contractor shall prepare or support preparation of ICD's to identify the physical, functional, and/or procedural parameters that must be controlled between interfacing elements. In addition, the contractor shall review interfacing elements, concur with the interface, or identify areas of nonconformance to the Government-provided ICD Contractual Index and Status Report. The ICD Contractual Index and Status Report is a compilation of baselined interface documents and shall be referenced in appropriate CEI specifications in lieu of listing all ICD's.

2.5 Drawing Identification

The contractor shall prepare drawings to document design solutions and document production or fabrication requirements for MSFC-controlled CEI's. The contractor shall prepare drawings for configuration identification in accordance with MIL-STD-100 and MIL-T-31000, as specified in the contract.

2.6 Identification Numbering

2.6.1 General

The contractor shall apply an identification numbering system that provides a unique identification number for items and supporting documentation to meet the requirements outlined in Sections 2.6.2 through 2.6.6 and Exhibit IV.

2.6.2 Specifications

The contractor shall assign specification identification numbers. Once a specification is identified, it will maintain that identification throughout the life of the program. Specification change documentation (notices, replacement pages, and instructions) identification numbering shall also be provided. These identification numbering requirements are contained in Exhibit IV.

2.6.3 Interface Requirements/Control Documents

IRD and ICD identification numbers usually will be provided to the contractor by MSFC. Consistent and accurate use of these identification numbers is required. If the contractor is responsible for development and maintenance of an ICD, any identification number applied

2.6.4 Drawing and Part Numbering

The contractor shall assign drawing and part identification numbers.

2.6.5 CEI Numbering

The contractor shall assign unique identification numbers to all hardware CEI's and software CSCI's. These numbers will continue to be used by MSFC upon delivery and will be maintained throughout the life of the CEI/CSCI.

2.6.6 Lot and Serial Numbering

The contractor shall utilize lot and serial numbering for proper identification and control of components, parts, and CEI's.

3.0 CONFIGURATION CONTROL

3.1 General

Configuration control is the systematic process of presentation, evaluation, and disposition of proposed changes and the implementation of approved changes into CEI's and baseline documentation after establishment of the baselines as defined in Section 2. Configuration control begins with the establishment of a configuration baseline and continues through the life cycle of the CEI. The contractor shall establish and operate a configuration control process that meets the requirements contained in this document.

3.2 Configuration Control Boards

The contractor shall establish configuration control boards (CCB's) for control of internal configuration identification documentation and to review, evaluate, and approve the submission of proposed changes, deviations, or waivers to established configuration baselines to MSFC.

3.3 Changes, Deviations, and Waivers

3.3.1 General

For the purposes of configuration control, the term "change" is hereby defined to include Engineering Change Proposals (ECP's), Field Engineering Changes (FEC's), Deviations, and Waivers (DAR's) that affect an established configuration baseline. Project Change Proposals (PCP's) are used to propose non-technical baseline changes.

3.3.2 Change Criteria

The contractor shall limit the initiation of changes to those that meet one or more of the following criteria:

- a. Correct safety, design, or performance deficiencies;
- b. Satisfy a change in operational or support requirements;
- c. Effect overall cost savings;
- d. Prevent or control program/project schedule slippage;
- e. Implement design improvements;
- f. Implement performance requirements changes.

3.3.3 Change Classification

For purposes of configuration control, changes shall be classified as Class I or Class II, depending upon their impact on established configuration baselines or other contract requirements. Change classification definitions and submission requirements are stated in the following paragraphs.

3.3.3.1 Class I Change

The contractor shall designate a proposed change as Class I when any of the baseline factors listed in Figure 1 are impacted. The contractor shall submit all Class I changes to the MSFC contracting officer. The contractor shall not implement a Class I change without specific direction from the MSFC contracting officer.

3.3.3.2 Class II Change

When the proposed change does not qualify as a Class I change as defined in 3.3.3.1, the contractor shall designate the proposed change as Class II. The contractor shall process, disposition, and implement

Class II changes within the contractor's CM system. Concurrent with internal processing, the contractor shall submit copies of all Class II changes to the responsible MSFC CCB, or its designated representative, for concurrence with the classification. In the case of notification of non-concurrence with the classification, the contractor shall resubmit the change as a Class I change.

3.3.4 Program Control Number

MSFC utilizes a Program Control Number (PCN) to identify the total contents of all Class I change packages. Upon request from the contractor, the PCN will be assigned by the MSFC CM function supporting the program or project. The contractor shall use this PCN on all change proposals, supporting documents, and implementing documents related to the change.

3.3.5 Change Priority

For all Class I changes, the contractor shall assign a proposed priority of emergency, urgent, or routine in accordance with the following criteria:

- a. Emergency. The contractor shall assign this priority if the proposed change is to correct a safety condition which could result in fatal or serious injury to personnel or in extensive damage to or destruction of equipment.
- b. Urgent. The contractor shall assign this priority if the proposed change is to correct a potentially hazardous condition which, if uncorrected, could result in injury to personnel or in damage to equipment and reduction of mission effectiveness. The contractor shall also use this classification for the following:
 - (1) Changes necessary to meet contractual requirements when lead time would necessitate slipping baselined production, activation, or construction schedules;
 - (2) Mission capability changes when delay would compromise the mission capability and result in unacceptable impact to contract, production, or mission launch schedules; and

(3) Changes associated with interface problems resulting from compatibility changes made by other contractors.

- c. Routine. The contractor shall assign this priority to a proposed change when "emergency" or "urgent" is not applicable.

The contractor shall not process a proposed change through the contractor's CM process in one priority level and upgrade to a more critical priority upon submission to MSFC.

3.3.6 Submission of Changes

The contractor shall ensure that all proposed changes are properly processed through the contractor's CM system and that proper engineering and management approvals are obtained prior to submission to MSFC. Requirements for the specific categories are covered in paragraphs 3.3.6.1 through 3.3.6.3.

3.3.6.1 Engineering Change Proposal

The contractor shall submit Class I engineering changes as an ECP using MSFC Form 2348 or equivalent format. MSFC Form 2348 and preparation instructions are contained in Exhibit V.

3.3.6.2 Deviation and Waiver Request

The contractor shall submit requests for deviations from or waivers to established Class I engineering requirements on MSFC Form 847, Deviation/Waiver Approval Request (DAR), or equivalent format. The DAR form and preparation instructions are contained in Exhibit VI.

3.3.6.3 Project Change Proposal

The contractor may submit changes to non-technical baseline requirements (e.g., Type 1 data requirements, special tasks) using the PCP, MSFC-Form 4240, or equivalent format. The PCP form and preparation instructions are contained in Exhibit V. When a proposed Class I change impacts both engineering and other non-technical contract requirements, the contractor shall submit the total change in an ECP instead of a separate PCP.

3.4 Field Engineering Change

The contractor shall use an FEC to request authorization to implement an emergency or urgent engineering change when time does not permit preparation and processing of an ECP at using sites on equipment for which MSFC retains design responsibility. Following approval of an FEC, the contractor shall submit a follow-up ECP to update the baseline design and documentation and address subsequent effectivities. FEC preparation and processing requirements are described in Exhibit V.

Mission Baseline	Design Requirements Baseline (Prior to Configuration Inspection and Baselining).	Product Baseline (After Configuration Inspection and Baselining)
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(1) Approved Program/Project Specification or equivalent.	(1) through (6) same as Mission Baseline.	(1) through (15) same as Design Requirements Baseline.
(2) Preliminary Software Requirements specification.	(7) Approved Part I CEI Specification(s), or equivalent.	(16) Change to approved Part II CEI Specifications (or equivalent), if any of the following are affected:
(3) Interface characteristics/documents.	(8) Imposed qualification and acceptance verification requirements.	(a) Interchangeability, substitutability, or replaceability as applied to CEI's (hardware/software), and to all subassemblies and parts except the pieces and parts of nonrepairable subassemblies.
(4) Safety.	(9) Qualification status previously accepted by the Government.	(b) Operation, test/checkout, logistics, maintenance documentation, or computer software.
(5) Other imposed technical requirements definition document.	(10) Government-Furnished Equipment.	(c) Compatibility with support equipment, trainers, training devices/equipment.
(6) Imposed or agreed-to price, fee, guarantees or schedules.	(11) Specified critical processes.	(d) Preset adjustments or schedules affecting operating limits or performance to such an extent as to require assignment of a new identification number.
	(12) Change of vendors of engineering critical components.	(e) Electrical interference to communications - electrical equipment or electromagnetic radiation hazards.
	(13) Retrofit.	(f) Functional or performance characteristics demonstrated or experienced in previously delivered articles.
	(14) Software Design Requirements Specification(s).	(g) Electromagnetic characteristics.
	(15) Software Interface Requirements.	(h) Responsibilities of other program elements.
		(17) Software Detail Design Specification(s) - As-Built.

Table 1. Class I Change Definition

NOTE: If the authorized FEC is a single effectivity change (i.e., it has no application to subsequent CEI's), the requirement for a follow-up ECP is not applicable. In this case, the only subsequent

action is incorporation of a copy of the authorized FEC into the Acceptance Data Package (ADP) for the affected CEI.

3.5 Modification Kit and Instructions

The contractor shall use Modification Kits (Mod Kits) for delivery and installation of an approved change to a previously delivered CEI. Requirements for the processing and accounting of Mod Kits are described in Exhibit VII.

4.0 CONFIGURATION ACCOUNTING

4.1 General

Configuration accounting is the process of ensuring the accurate identification of configuration baselines, providing the accounting of changes to those baselines, and providing the status of all in-process changes. The contractor shall establish or utilize an existing information system to meet the requirements of configuration accounting.

4.2 Configuration Accounting Requirements

The contractor shall implement and maintain a configuration accounting system capable of the following general requirements:

- a. Providing a complete record of configuration identification documentation for each CEI;
- b. Providing a record of all changes to configuration baseline documents, including manufacturing records and field modifications, throughout the life cycle of the CEI;
- c. Providing status of all pending, in-process, and
- d. Maintaining a record of all internal change activity (e.g., Class II changes, minor nonconformance) against CEI's; and
- e. Accumulating and formatting the data necessary to provide routine and special configuration accounting reports as outlined in Sections 4.3.1 through 4.3.4 and 4.4.2, and as required by the contract.

4.3 Configuration Accounting Reports

The contractor shall provide configuration accounting reports as required by the contract. Report data element outlines are contained in paragraphs 4.3.1 through 4.3.4.

4.3.1 Dispositioned Class I Change Activity Report

This report shall list all proposed changes, including deviations and waivers, that have received MSFC disposition action and shall be arranged in a change proposal number sequence. The following data elements shall be included:

- a. Identification of the change proposal, including the basic number, revision number, title, and associated PCN;
- b. Identification of the CEI affected, including the number, nomenclature, and CEI effectivity by serial number(s);
- c. Identification of contractual change authorization including number and date;
- d. Disposition of the change proposal, i.e., ``Approved'', ``Approved with Changes'', or ``Disapproved''; and
- e. Identification and date of contractor's internal authorization documentation.

4.3.2 Pending Class I Change Activity Report

This report shall list all Class I change proposals that are pending, either internal contractor approval or MSFC approval, and shall be arranged in a change proposal number sequence. The following data elements shall be included:

- a. Identification of the change action, including the basic number, revision number, title, and associated PCN;
- b. Identification of the CEI affected, including number, nomenclature and CEI effectivity by serial number(s); and,
- c. Depending on the processing status, the actual or estimated date of submittal to MSFC.

4.3.3 Configuration Identification Report

This report shall identify the baseline configuration and all configuration change actions for each CEI. Hardware and software changes shall be listed separately from DAR actions. The following data elements shall be included:

- a. Contract and contractor identification;
- b. CEI identification including, as appropriate, CEI number and nomenclature, part number, and specification number;
- c. Configuration change data including the following:
 - (1) Change proposal identification including type of action (e.g., ECP, Class II change, or DAR), number, title, and associated PCN (if applicable);
 - (2) Change application including item(s) affected (e.g., hardware, software, or documentation), first and total effectivities, and the incorporation or installation points; and,
 - (3) Change disposition including the identification of contractual change authorization.

4.3.4 Change Incorporation Status Report

This report shall list the status of ECP incorporation into CEI's and shall be organized by CEI number. The following data elements shall be included:

- a. CEI identification number and serial number;
- b. Change proposal number, title, type of change, and associated PCN;
- c. Change effectivity, engineering release date, and incorporation point;
- d. In-line incorporation completion date, scheduled and actual, as appropriate; and
- e. Mod Kit data shall include identification, authorization, effectivity, man-hour estimates and status, installation location, shipping date (scheduled and actual), and completion date(s) for installation and retest, if required.

4.4 Configuration Accounting Certifications

4.4.1 Selected MSFC Reports

Periodically, as determined by contract requirements, the contractor shall review selected MSFC configuration accounting and status reports for accuracy. The contractor shall provide concurrence notification or corrections to the content of the report to the program or project CM office.

4.4.2 Special Contractor Reports

The contractor shall have the capability of retrieving from the contractor's configuration accounting system special reports listing all approved engineering changes, deviations, and waivers for a designated CEI effectivity or time period. In accordance with contract requirements, the contractor shall certify the accuracy of the report and submit the report to MSFC.

4.5 Engineering Release

The contractor shall establish an engineering release system to issue configuration documentation to functional activities and to authorize the use of configuration documentation associated with an approved configuration. The contractor shall maintain current and historical engineering release information for all CEI's and their component parts. The contractor's engineering release system shall meet the requirements of Exhibit VIII.

4.5.1 Specification Release and Approval

For contractor-prepared specifications, a contractor's signature shall be included to certify that the document has been reviewed and is ready for baseline action. The contractor shall submit the proposed specification by ECP to MSFC for approval. After approval and release, the specification establishes the appropriate baseline.

4.5.2 Engineering Release Records

The contractor shall use engineering release records to release new or revised configuration documentation. Engineering records shall contain, as a minimum, the information specified in Exhibit VIII.

5.0 CONFIGURATION VERIFICATION

5.1 General

Configuration verification is the process of applying reviews, audits, and inspections to provide assurance that CEI's have been properly identified, baselined, and controlled throughout the item's life cycle and that the proper data and reports have been maintained to verify the configuration.

5.2 Design Reviews

The contractor shall support design reviews as stated in Exhibit IX and as required by the contract. Following completion of each review, the contractor shall submit the resulting configuration documentation package to MSFC to establish the appropriate configuration baseline.

5.3 Other Reviews

Other reviews as specified in the contract may be conducted by MSFC and shall be supported by the contractor. The requirements for these reviews are provided in Exhibit IX.

5.4 Review Item Discrepancies

During each of the design reviews, MSFC will use Review Item Discrepancies (RID's) to document and track closure of design discrepancies, errors, omissions, and concerns. The contractor shall participate in the RID resolution process by providing technical evaluation and recommended resolution. If required by the contract SOW, the contractor shall track the status of open RID's and provide periodic status reports to MSFC.

5.5 Configuration Management Audits

CM audits will be conducted periodically by MSFC to verify the adequacy of the contractor's implementation of contractual CM requirements and to identify any areas needing correction or improvement. Detailed contractor support requirements shall be defined and mutually agreed-to by the applicable MSFC program/project office and the contractor. Types of support will include physical facilities (including housekeeping and security), availability of appropriate standards, procedures, clerical and administrative personnel, CM organization representation, project management representation, and resolution of findings.

5.6 Verification and Validation Records

The contractor shall establish organizational procedures for the preparation, processing, and disposition of hardware verification and software/firmware verification and validation records, including as-built records and ADP's. Detailed requirements for the establishment and maintenance of verification and validation records are provided in Exhibit X.

EXHIBIT I
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EXHIBIT I

CONFIGURATION MANAGEMENT PLAN

1.0 PURPOSE

This exhibit provides the format and guidelines to be followed in the development of a CM plan for the implementation of contractual CM requirements.

2.0 SCOPE

This exhibit shall be implemented in accordance with the terms and conditions of the contract. The plan, when approved, shall establish the formal agreement between MSFC and the contractor on the CM policy and methods to fulfill the CM requirements for a given contract.

3.0 CM PLAN REQUIREMENTS

3.1 Section 1 - Introduction and Scope

The introduction to the plan shall state the plan's purpose and objective(s) and briefly describe the contractor's general management policy and methods as applied to configuration management.

The scope shall include a brief description of the system and/or top level hardware, firmware, and software items and the lower level components to which the CM plan pertains.

3.2 Section 2 - Applicable Documents

Only those documents referenced in the following sections of the CM plan shall be listed. If the applicable documents list is extensive, it may be included in an appendix or a separate document and referenced in this section. This section shall be organized as described in the following paragraphs.

3.2.1 Government Documents

The documents shall be listed in the following order:

Specifications
Standards
Drawings
Other Publications (e.g., manuals, regulations, handbooks)

3.2.2 Non-Government Documents

The documents shall be listed in the following order:

Specifications
Standards
Drawings
Other Publications (e.g., manuals, regulations,
handbooks)

3.3 Section 3 - Organization

This section shall describe and graphically portray the contractor's organization with emphasis on CM activities and shall include the following:

- a. The relationship to and integration of the contractor's project organization and functional organization(s).
- b. The responsibility and authority for CM in all participating groups and organizations including their roles in CCB's.
- c. The functional integration of CM activities into other program activities such as technical, management, and design reviews.
- d. The identification and description of the contractor's CM organization, including responsibilities.
- e. The organizational interfaces between the contractor's CM organization and the Government, other contractors, and subcontractors.
- f. The management integration activities between CM and project management. The contractor shall define the relationship between events critical to CM and schedule control; e.g., sequencing of design reviews, engineering release, production, testing.

3.4 Section 4 - Configuration Management Phasing and Milestones

The contractor shall propose the major milestones for implementation of CM. These milestones shall include, but not be limited to, the following:

- a. Phasing for implementation of the specification program, including release and submittal of

- specifications and supporting configuration documentation.
- b. Establishment of internal developmental and contractual configuration baselines.
- c. Implementation of internal and Government configuration control.
- d. Establishment of the contractor's CCB's.
- e. Implementation of a status accounting system and provision of reports or access to status accounting information.
- f. Establishment of interface control agreements.

3.5 Section 5 - Configuration Identification

This section shall describe the contractor's methods and procedures for meeting the requirements of Section 2.0 of the basic portion of this document, including the following:

- a. Selection of hardware and software items requiring the application of CM.
- b. Establishment of the Mission, Design Requirements and Product Baselines, definition of the configuration baseline documentation required for each, and a graphic illustration of configuration documentation relationships.
- c. Definition of engineering release process and correlation to manufactured/fabricated products.
- d. Assignment, application, and control of hardware and software configuration identifiers including specification, drawing, and document numbers; nomenclature; serial, lot, and part numbers; and version identifiers for software and firmware.

3.5.1 Specifications

The plan shall identify the hardware and software specifications needed to establish and control the configuration baselines. A Specification Tree shall be included that depicts the interrelationship of the contractor-prepared specifications and the relationship to applicable higher level specifications. The plan shall also specify the intended time in the program when the above specifications will be presented for delivery (or otherwise made available) to MSFC. Any limitation on

delivery to, or use by, MSFC of contractor-prepared specifications shall be stated.

3.5.2 Drawings

This section shall specify the drawing practices for application to the contract including the effects of application of this document, MIL-STD-100, and standards referenced therein. Drawings and associated lists shall be prepared in accordance with requirements contained in the contract. Any limitation on delivery or use of contractor-prepared drawings shall be stated.

3.6 Section 6 - Interface Control

This section shall describe the methods for controlling interface requirements between elements of the program/project. These methods shall cover the following elements of interface control:

- a. Establishment of initial interface baseline documents.
- b. Incorporation of and compliance with contractually imposed interface documents.
- c. Control of changes to interface documents including initiation of proposed changes, change coordination, change submission, and incorporation of approved changes.
- d. Review and evaluation of proposed and authorized changes to related interface documents controlled by other contractors or activities.

3.7 Section 7 - Configuration Control

The contractor shall describe the procedures to be used for meeting the requirements of Section 3 of the basic portion of this document, plus any applicable exhibits or references. In these requirements, the term "processing" is defined as the range of activities from initiation of the action through verification of change incorporation or resolution of nonconformances. This description shall include the following:

- a. Establishing organization, functions, responsibilities, and authority of CCB's;
- b. Classifying changes and determining the level of authority for change approval or concurrence;

- c. Processing Class I ECP's and PCP's and processing Class II engineering changes;
- d. Processing DAR's;
- e. Processing Specification Change Notices (SCN's)/Document Change Notices (DCN's);
- f. Processing Interface Revision Notices (IRN's) and Preliminary IRN's (PIRN's);
- g. Processing and controlling FEC's; and
- h. Processing and controlling mod kits.

3.8 Section 8 - Configuration Accounting

The contractor shall describe procedures for meeting the requirements of Section 4 of the basic portion of this document, including the following:

- a. Methods for collecting, recording, processing, and maintaining data necessary to provide CM accounting information by means of reports or database access.
- b. Description of reports or information system content as related to the identified data elements.
- c. Frequency of reporting and distribution and/or methods of access to CM information database.

3.9 Section 9 - Configuration Verification and Validation

The contractor shall describe the system for verifying hardware and verifying and validating software/firmware that the configuration identification documentation and deliverable CEI's/CSCI's are in compliance with the contractual baseline. As a minimum, the contractor's methods shall be addressed for the following:

- a. Demonstrating that the contractually required qualification verification was accomplished and that it substantiated compliance of the "as-verified" and "as validated" (software/firmware) design with the original performance and configuration design requirements and approved changes.
- b. Demonstrating that the contractually required acceptance verification/validation was accomplished and that it substantiated compliance of the performance and configuration of the article being delivered with the "as-qualified" design.

3.10 Section 10 - Configuration Reviews, Inspections, and Audits

The contractor shall describe his plans for conducting and/or providing CM support to appropriate reviews, inspections, and audits as contained in Section 5 of the basic portion of this document and Exhibit IX.

3.11 Section 11 - Subcontractor/Vendor Configuration Management Control

The contractor shall describe the methods for ensuring that subcontractors and vendors comply with CM requirements, insofar as their activity impacts the contractor's CM commitments to MSFC.

3.12 Section 12 - Modification Kits and Instructions

The contractor shall specify the planning for and methods to be used in (1) identification of retrofit actions, (2) development of mod kits and instructions, and (3) control and closeout of kit installation. Mod kit requirements are contained in Exhibit VII.

4.0 CM PLAN APPROVAL AND MAINTENANCE

The contractor shall submit the plan for approval by MSFC and shall maintain the plan with all proposed changes and revisions submitted to MSFC for review and approval. Submittal and update of the plan shall be as specified in the contract data requirements.

EXHIBIT II
SPECIFICATION PRACTICESTABLE OF CONTENTS

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EXHIBIT II

SPECIFICATION PRACTICES

1.0 PURPOSE

This exhibit provides uniform practices for the preparation and maintenance of program peculiar specifications prepared for MSFC. This exhibit is applicable to contractors who are providing products or services for MSFC-managed program or project activities.

2.0 SCOPE

This exhibit establishes the format and content of program peculiar specifications of the following types:

- a. Program/Project/System Specification
- b. CEI Detail Specification (Prime Item) - Parts I and II
- c. Critical Component (Item) Detail Specification - Parts I and II
- d. CEI Detail Specification (Identification Item) - Parts I and II
- e. CEI Detail Specification (Facility) - Part I
- f. CEI Detail Specification (Requirements Item) - Part II
- g. Software Requirements Specification
- h. Software Interface Requirements Specification
- i. Software Product Specification

3.0 REQUIREMENTS

Specifications prepared in accordance with this exhibit are intended for use in design, development, and fabrication of program/project peculiar items and for services required for program/project peculiar application. MIL-STD-490A, Specification Practices, as tailored in the following Table II-1, forms the basis for MSFC specification requirements. The specification types to be prepared for any particular application will be defined in the contract SOW and/or the contract DPD.

Table II-1. MIL-STD-490A Tailoring

PARA NO.	TITLE	TAILORING
1.1	Scope	DOD term Configuration Item is synonymous with MSFC term CEI.
1.3	Classification	See Table II-2 for MSFC specification types and governing requirements.
1.4	Definitions	See Exhibit I for CEI definition which is synonymous with DOD term Configuration Item.
2.1	Government Documents	Add any applicable NASA/MSFC documents in accordance with contract requirements.
3.1.1.1	Functional Configuration Identification (FCI)	The FCI is essentially the same as the MSFC Mission Baseline as established by the PRR approved configuration identification package.
3.1.1.2	Allocated Configuration Identification (ACI)	The ACI is the same as the MSFC Design Requirements Baseline as established by the PDR approved configuration identification package.
3.1.3.1	Type A - System/Segment Specification	Comparable to the MSFC Program/Project/System Specification. See Table II-2 for documents containing format and content requirements.
3.1.3.2	Type B - Development Specifications	These are essentially the same as MSFC CEI Detail Specifications (Part I) for various types of items.
3.1.3.2.5	Type B5 - Software Development Specification	Comparable to the MSFC Software Requirements Specification. (MM8075.1, DRD-STD-SW-RQS) See Table II-2 for documents containing format and content requirements.
3.1.3.3	Type C - Product Specifications	These are essentially the same as MSFC CEI Detail Specifications (Part II) for various types of items.
3.1.3.3.5	Type C5 - Software Product Specification	Comparable to the MSFC Software Product Specification. See Table II-2 for documents containing format and content requirements.
3.2.16.6	Designation of FSC Code	For MSFC items, refer to CAGE code in accordance with Cataloging Handbook H4/H8.
3.3	Changes and Revisions	Use the requirements contained in paragraph 3.3, Specification Maintenance, in this exhibit.
4.1.2	Classification	This section through paragraph 4.1.2.2 is not applicable to MSFC specifications.
4.4	Section 4 - Quality Assurance Provisions	For all MSFC hardware CEI specifications, this section shall be replaced by an MSFC verification section as defined in Appendix A, including Figures II-1 and II-2. Software verification and validation requirements are contained in Appendices B and C.
4.6	Section 6 - Notes	Only the first two sentences are applicable. Paragraphs 4.6.1 through 4.6.5 are not applicable.
6.2	Data requirements list and cross reference	Referenced data item descriptions are not applicable. See Table II-2 for documents containing format and content requirements.
Appendices	APPENDIX I - XV	See Table II-2 for appendices that are applicable to MSFC specifications.

3.1 Specification Format and Content

Table II-2 provides the detailed specification format and content requirements that shall be used in the preparation of MSFC program-unique specifications.

Table II-2. Cross-Reference of MSFC Specification Types to Documents Containing Format and Content Requirements

MSFC SPECIFICATION TYPE	DOCUMENTS CONTAINING FORMAT AND CONTENT REQUIREMENTS
Program/Project/System Specification	Appendix A to this Exhibit
CEI Detail Specification (Prime Equipment) - Part I	MIL-STD-490A, Appendix II - Prime Item Development Specification
Critical Component Detail Specification - Part I	MIL-STD-490A, Appendix III - Critical Item Development Specification
CEI Detail Specification (Identification Item) - Part I	MIL-STD-490A, Appendix IV - Non-complex Item Development Specification
CEI Detail Specification (Facility) - Part I	MIL-STD-490A, Appendix V - Facility or Ship Development Specification
Software Requirements Specification	Appendix B to this Exhibit
Software Interface Requirements Specification	Appendix C to this Exhibit
CEI Detail Specification (Prime Equipment) - Part II	MIL-STD-490A, Appendix VIII - Prime Item Product Fabrication Specification
Critical Component Detail Specification - Part II	MIL-STD-490A, Appendix X - Critical Item Product Fabrication Specification
CEI Detail Specification (Identification Item) - Part II	MIL-STD-490A, Appendix XI - Non-complex Item Product Fabrication Specification
CEI Detail Specification (Requirements Item) - Part II	MIL-STD-490A, Appendix XII - Inventory Item Specification
Software Product Specification	Appendix D to this Exhibit

3.2 Addendum Specification

An addendum may be developed against a CEI Detail Specification to create, in effect, a new specification. An addendum specification would be used when an item to be designed and developed is so similar to an existing CEI that it is desirable to restrict design activity to the same criteria but with additions/deletions to meet unique requirements. An addendum changes a basic CEI Detail Specification by adding or deleting requirements on a paragraph-by-paragraph basis. An addendum shall be identified with a specific issue of a basic specification. The specification so created (basic specification plus addenda) then becomes controlled and maintained as a separate and distinct specification, to be updated and revised as necessary. Appendix E provides format and content requirements for addendum specifications.

3.3 Specification Tailoring and Traceability

Specifications may be tailored to meet the needs of specific programs by the addition of subparagraphs. This activity will be initiated at the program level and followed through the lowest specification level for proper flowdown and traceability of requirements.

3.4 Specification Maintenance

Proposed corrections and updates to specifications shall be submitted by SCN as stated in paragraphs 3.4.1.1.1 and 3.4.1.1.2. Cleanup revisions with no text changes do not require an SCN and will be submitted in accordance with paragraph 3.4.1.1.3. SCN's shall be submitted by ECP as described in Exhibit V. Once the proposed change is approved, the contractor shall prepare replacement pages and a Specification Change Instruction (SCI) identifying the change(s). The specification maintenance requirements, forms, and their application are covered in the following paragraphs.

3.4.1 Specification Change Notice

The SCN shall be used by the change originator to describe a proposed specification change or revision. The SCN records the exact proposed change(s) or revision with (1) a "From/To" format to change less than 25 percent of the specification, or (2) a "General Description" to change 25 percent or more of the specification.

3.4.1.1 Text Change Format

3.4.1.1.1 Changes of Less than 25 Percent

When the proposed change impacts less than 25 percent of the pages of the specification, the originator shall list information to be added, deleted, or changed in a "From/To" format. The "From" statement shall be a verbatim quote of the material in the specification that is to be changed. The "To" statement shall state the proposed new wording.

3.4.1.1.2 Changes of 25 Percent or More

When a specification change impacts 25 percent or more of the pages of the specification, the originator may submit a total revision of the document. In this case, the SCN shall provide a general description of the proposed changes, identifying the paragraphs or sections that are changed and describing the purpose of the changes.

3.4.1.1.3 Cleanup Revisions with No Text Changes

A revision incorporating approved SCN's with no text changes may be made to improve clarity and readability. The revised specification shall be submitted for approval by an ECP, and shall be accompanied by an SCI which contains the authorization data, i.e., the previously approved SCN's being incorporated by the revision. ECP submission requirements are contained in Exhibit V.

3.4.1.2 Specification Change Notice Preparation Instructions

The SCN shall be prepared using the format shown in Figure II-1 or equivalent. The required information is described as follows:

<u>Block</u>	<u>Instruction</u>
1	CONTRACTOR NAME AND CAGE CODE - Self-explanatory.
2	SPECIFICATION NO - Enter the identification number of the specification affected.
3	REV - Enter the revision letter of the specification affected.
4	SCN NO - Enter the SCN sequence number determined by the specification custodian.
5	PAGE NO. AND DATE - Self-explanatory.
6	PROGRAM/PROJECT NAME - Self-explanatory.
7	CEI NOMENCLATURE AND CEI NUMBER - Enter the nomenclature and identification number of the hardware, firmware, or software CEI or critical item governed by the specification.
8	ECP NUMBER, PCN, CONTRACT NUMBER - Self-explanatory.
9	CONTRACT AUTHORITY - Will be entered by MSFC.
10	EFFECTIVITY - CEI or other effectivity of this change.
11	DESCRIPTION OF CHANGE - Provide definitive description of the change as described in paragraph 3.4.1.1.

March 17, 1995

SPECIFICATION CHANGE NOTICE

CONTRACTOR NAME: <div style="text-align: center;">①</div>		CAGE CODE <div style="text-align: center;">①</div>	SPECIFICATION NO. <div style="text-align: center;">②</div>	PAGE NO. 1 OF ____ <div style="text-align: center;">⑤</div>
		SCN NO. <div style="text-align: center;">④</div>		DATE: <div style="text-align: center;">⑤</div>
PROGRAM/PROJECT NAME: <div style="text-align: center;">⑥</div>		CEI NOMENCLATURE: <div style="text-align: center;">⑦</div>		CEI NUMBER <div style="text-align: center;">⑦</div>
ECP NUMBER: <div style="text-align: center;">⑧</div>	PCN <div style="text-align: center;">⑧</div>	CONTRACT NUMBER <div style="text-align: center;">⑧</div>	CONTRACT AUTHORITY: <div style="text-align: center;">⑨</div>	
EFFECTIVITY: <div style="text-align: center;">⑩</div>				
DESCRIPTION OF CHANGE: <div style="text-align: center;">⑪</div>				

Figure II-1. Specification Change Notice Format

3.4.2 Specification Changes

The following paragraphs present requirements for preparation and identification of specification changes incorporating approved SCN's.

3.4.2.1 Replacement Pages

The replacement pages shall be prepared by the document originator in accordance with contract direction to incorporate "approved" or "approved with changes" SCN's. Replacement pages shall be used to incorporate all specification changes. Pen and ink changes shall not be permitted.

3.4.2.1.1 Replacement Page Notation

The replacement page shall identify all previously released SCN's except when the specification is revised. Changed text shall be identified by a vertical line bar to the right of the change and notation of the SCN number. All approved SCN's shall be indicated until the specification is revised, at which time all change notation shall be removed.

3.4.2.1.2 Replacement Page Identification

The replacement page header shall include the specification number, revision letter (if applicable), and the contract change order date for the SCN. A supersession statement shall be included at the bottom of the page stating: "Supersedes page ____ dated ____." The replacement page number shall reflect the page number of the specification page that it replaces. If the text on any page overflows the current page, then the overflow shall be continued on an additional page that exhibits the same page number with a decimal and number added sequentially to that page number.

3.4.3 Specification Revision

When specification revisions are required (see paragraphs 3.4.1.1.2 and 3.4.1.1.3), the total document shall be printed without change notations. Each page shall be identified in the header with the original specification number followed by the next sequential alphabetical revision designated and the revision approval date.

3.4.4 Specification Change Instruction

3.4.4.1 Specification Change Instruction Requirements

The SCI shall be prepared with each specification replacement package and each revision. The SCI shall record all SCN's (approved, disapproved, or pending) issued against the specification and shall provide replacement page deletion/insertion instructions. The SCI shall also provide a chronological listing of all changes to the specification. The SCI shall not receive a specification page number and shall be filed immediately following the signature page.

3.4.4.2 SCI Required Data Elements

The following data elements shall be included in the SCI:

- a. SCI release date
- b. Specification number
- c. Change identification including ECP No., date and PCN*
- d. SCN number*
- e. Contract modification number and date*
- f. Replacement page instructions: Enter the page number(s) of the page(s) to be replaced, deleted, or added, or enter the new revision level.*

* NOTE: Items c. through f. are cumulative to show the complete history of the specification changes and revisions.

Figure II-2, Specification Change Instruction, provides a suggested format for preparation of an SCI.

SPECIFICATION CHANGE INSTRUCTION				
SPECIFICATION NO.:			DATE OF RELEASE:	
			PAGE ____ OF ____	
SCN No.	ECP No./ DATE	PCN	CONTRACT MOD/ DATE	REPLACEMENT PAGE INSTRUCTIONS

Figure II-2. Specification Change Instruction Format

APPENDIX A

PROGRAM/PROJECT/SYSTEM SPECIFICATION

10.0 General

This specification may be used for program or project level requirements and/or system level requirements and constraints. The term "system" is defined as a collection of identifiable elements that combine to make up an item which may be a final use item or may be part of a higher grouping. A suggested outline for this specification is provided at the end of this Appendix.

10.1 Paragraph 1, "SCOPE"

This paragraph and/or sub-paragraphs shall identify the system to which this specification applies and shall provide a system overview. A statement shall be included to specify that all elements and items of the system shall conform to the requirements of this specification and that requirements shall be reflected in subsidiary specifications.

10.1.1 Paragraph 1.1, "Program/Project/System Overview"

This paragraph shall briefly identify and state the purpose of the program/project/system to which this specification applies.

10.1.2 Paragraph 1.2, "Document Overview"

This paragraph shall summarize the purpose and contents of this specification.

10.2 Paragraph 2, "APPLICABLE DOCUMENTS"

All and only those separate documents identified and referred to in paragraphs 3, 4, 5, and the appendices of the specification shall be listed in this paragraph. This paragraph shall include the following statements:
"The following Government and non-Government documents of the exact issue shown form a part of this specification to the extent specified herein. In the event of conflict between the referenced documents and the contents of this specification, the contents of this specification shall be considered a superseding requirement."

10.2.1 Paragraph 2.1, "Government Documents"

Government documents shall be listed by number and title in the following order:

SPECIFICATIONS:

- Federal
- Military
- NASA/MSFC
- Other Government Agency

STANDARDS:

- Federal
- Military
- NASA/MSFC
- Other Government Agency

DRAWINGS

OTHER PUBLICATIONS:

Manuals, Handbooks, Regulations, Bulletins, etc.

The following statement shall appear at the conclusion of this list of documents: "Copies of Government documents required in connection with the requirements of this specification should be obtained from MSFC or as directed by the contracting officer."

10.2.2 Paragraph 2.2, "Non-Government Documents"

Non-Government documents shall be listed by number and title in the following order:

SPECIFICATIONS

STANDARDS

DRAWINGS

OTHER PUBLICATIONS

The source for all documents not available through the MSFC Repository shall be listed.

10.3 Paragraph 3, "SYSTEM REQUIREMENTS"

This section shall be divided into the following paragraphs and subparagraphs to specify the requirements for the system to which this specification applies. These requirements shall be the basis for verification specified in paragraph 4.

10.3.1 Paragraph 3.1, "Definition"

This paragraph shall include a general summary of the subparagraphs which are a part of the "Definition" heading.

10.3.1.1 Paragraph 3.1.1, "General Description"

This paragraph shall contain a brief description of the system and shall include a diagram of system elements.

10.3.1.2 Paragraph 3.1.2, "Missions"

This paragraph shall include a description of the missions involved that affect system performance and design.

10.3.1.3 Paragraph 3.1.3, "Interface Definition"

This paragraph shall be divided into subparagraphs as necessary to define interfaces with other systems. The interface definition shall identify the purpose of the interface and describe the interface requirements. Detailed quantitative interface requirements shall be defined in separate specifications, Interface Requirements Documents (IRD's), or Interface Control Drawings/Documents (ICD's) and referenced in this specification. All referenced interface documents will be considered part of this specification. ICD's shall be incorporated by reference to an ICD Contractual Index and Status Report, or by identification of the ICD(s).

10.3.1.4 Paragraph 3.1.4, "Operational Concepts"

This paragraph shall include a description of operational concepts as they affect performance and design. Each concept shall be included in an appropriate subparagraph. Typical concepts include those for launch site, rendezvous, recovery, and servicing.

10.3.1.5 Paragraph 3.1.5, "Systems Engineering Requirements"

This paragraph shall state requirements for systems engineering analyses necessary to translate this specification into operational equipment. This paragraph shall incorporate, by reference, graphic portrayals (e.g., functional schematics and functional flows) which establish general relationships with related items.

10.3.1.6 Paragraph 3.1.6, "Government-Furnished Equipment/
Property List"

This paragraph shall list the Government-furnished equipment/property (GFE/GFP) to be incorporated, identified by nomenclature, specification number, and/or part number. If extensive, the GFE/GFP list may be included in an appendix or separate document referenced in this paragraph.

10.3.1.7 Paragraph 3.1.7, "Critical Components (Items)"

This paragraph shall specify the criteria for identifying engineering or logistics critical components (items); see paragraph 3.1.3.2.2 of MIL-STD-490A.

10.3.2 Paragraph 3.2, "Characteristics"

Pertinent introductory material may be included in this paragraph.

10.3.2.1 Paragraph 3.2.1, "Performance"

This paragraph shall state overall performance characteristics, in functional terms, and specific performance characteristics for each functional area such as mechanical, electrical, propulsion, life support, communications, guidance and navigation, experiments, and instrumentation. The performance characteristics specified shall form the basis for technical features and development. Separate subparagraphs shall be used to state general performance characteristics for each functional area. Each functional area may be subdivided to state performance characteristics as they relate to operational phases and modes.

Paragraph 3.2.1.1, "General Performance"Paragraph 3.2.1.2, "First Functional Area Performance"
through
Paragraph 3.2.1.n, "Nth Functional Area Performance"10.3.2.2 Paragraph 3.2.2, "Physical"

This paragraph shall state the requirements for the physical characteristics of the system, such as the following:

- a. Weight limits, center of gravity, and moments of inertia; and
- b. Dimensional and volume limitations (e.g., crew space, operator station layout).

10.3.2.3 Paragraph 3.2.3, "Reliability"

This paragraph shall state reliability requirements in quantitative terms, defining conditions under which the requirements are to be met. A reliability apportionment model may be included to support the apportionment of reliability values assigned to program elements for their share in achieving required program reliability.

10.3.2.4 Paragraph 3.2.4, "Maintainability"

This paragraph shall specify quantitatively the level of maintenance required at each location. This paragraph shall also specify elements of analysis in terms of criticality, accessibility, fault isolation and detection, commonality and standardization, safety, redundancy, feasibility of repair, and spares. This paragraph shall identify constraints which alleviate analysis in specific areas.

10.3.2.5 Paragraph 3.2.5, "Environmental Conditions"

This paragraph shall specify the environmental conditions that the system must withstand or be constrained by during operation, transportation, and storage. The requirements imposed by environmental conditions shall include the following:

- a. Natural environmental conditions; e.g., surface weather conditions, upper atmospheric conditions, space conditions such as near vacuum, low gravity and solar radiation; and
- b. Induced environmental conditions and constraints; e.g., vibration, shock, acoustical.

10.3.2.6 Paragraph 3.2.6, "Transportability/Transportation"

This paragraph shall state constraints on transportability and shall identify standard and nonstandard modes of transportation required.

10.3.2.7 Paragraph 3.2.7, "Operational Availability"

This paragraph shall state the probabilistic time capability requirements as a measure of the expected time-span performance of each stated function. These requirements may be expressed in terms of one or more of schedule time, interval, period, or steady state condition. If early operation is required and a potential lower probability is acceptable, this requirement shall be specified separately.

10.3.2.8 Paragraph 3.2.8, "Storage"

This paragraph shall specify the types of storage required, maximum storage time, limitations on maintenance in a stored condition, and other storage requirements affecting design.

10.3.3 Paragraph 3.3, "Design and Construction Standards"

This paragraph shall be divided into subparagraphs that specify minimum system design and construction standards which have applicability to system equipment. Requirements which add to, but do not conflict with, requirements contained in this specification may be included in individual specifications. In addition, this paragraph shall specify the criteria for the selection and imposition of Federal, military, NASA, and contractor specifications and standards. A listing of and selection criteria for MSFC-approved specifications are contained in MSFC-MNL-2348. Additional specifications shall be selected in accordance with MIL-STD-970.

10.3.3.1 Paragraph 3.3.1, "General"

This paragraph shall specify those general design and construction standards that apply without regard to whether the equipment is electronic, hydraulic, mechanical, etc.

10.3.3.2 Paragraph 3.3.2, "Materials, Parts, and Processes"

This paragraph shall specify those system-unique requirements governing the use of materials, parts, and processes in the design of system equipment. General areas of concern include requirements for safety, compatibility, product reliability, and economy. The following are examples of topics that shall be considered, as appropriate: flammability, odor, outgassing, use of critical materials, stress corrosion, surface corrosion and protective finishes, moisture and fungus resistance, radiation, lubricants, vacuum stability, potting, and molding compounds.

10.3.3.3 Paragraph 3.3.3, "Design"

This paragraph shall contain design standards, requirements, and constraints imposed on the system or required by the system to meet overall system expectations. Examples of areas to be covered include contamination control, coordinate system, external and

internal electrical/electronic considerations, safety factors, and redundancy.

10.3.3.4 Paragraph 3.3.4, "Identification and Marking"

This paragraph shall specify requirements for nameplates, part numbering and marking, serial and lot number marking, software media marking, and other identifying markings required for the system. Reference may be made to existing standards on the content and application of markings.

10.3.3.5 Paragraph 3.3.5, "Workmanship"

This paragraph shall specify requirements applicable to fabrication, certification of workers in particular trades, etc.

10.3.3.6 Paragraph 3.3.6, "Interchangeability and Replaceability"

This paragraph shall specify the requirements for system equipment to be interchangeable and replaceable.

10.3.3.7 Paragraph 3.3.7, "Safety"

This paragraph shall specify those safety requirements basic to the design of the system that prevent personnel injury and equipment degradation without degrading operational capability. These requirements shall consider equipment characteristics, methods of operation, and environmental influences and shall include such things as use of redundancy; restricting the use of dangerous materials where possible; abort/escape provisions from enclosures; gas detection and warning devices; grounding of electrical system; cleanliness and decontamination; and explosion proofing.

10.3.3.8 Paragraph 3.3.8, "Human Engineering"

This paragraph shall specify human engineering requirements for the system by reference to applicable documents and identification of any special or unique requirements (e.g., constraints on allocation of functions to personnel and communications and personnel/equipment interactions). This paragraph shall include those specific areas, stations, or equipment that require concentrated human engineering attention due to the sensitivity of the operation or criticality of the task.

10.3.3.9 Paragraph 3.3.9, "Computer Resources"

This paragraph shall specify the requirements for computer software if the system includes computer software configuration items (CSCI's). Entries shall include, as appropriate, programming language requirements, program design standards, program coding standards, and other design constraints that have general applicability to the software CSCI's within the system.

10.3.4 Paragraph 3.4, "Documentation"

This paragraph shall specify the requirements for system hardware and software documentation to be produced during the development activity associated with the program/project/system.

10.3.5 Paragraph 3.5, "Logistics"

This paragraph shall specify logistic considerations and conditions that apply to operational requirements and that must be integrated into design. These considerations and conditions may include the following:

- a. Maintenance (e.g., multi-purpose test equipment, repair versus replacement criteria, maintenance cycles, and maintenance accessibility);
- b. Supply requirements (e.g., new items and resupply methods, and distribution and location of stocks);
- c. Facilities and facility equipment (e.g., impact on existing and requirements for new facilities and equipment).

10.3.6 Paragraph 3.6, "Personnel and Training"

This paragraph shall specify those requirements that must be integrated into the design and will allow determination of personnel training and training equipment/facility requirements.

10.3.7 Paragraph 3.7, "Major Components Characteristics"

This paragraph shall describe the relationship between the major components of the system and shall be divided into subparagraphs as required to identify and describe each major component of the system.

Paragraph 3.7.1, "First System Component"
through
Paragraph 3.7.n, "Nth System Component"

The title of this paragraph shall include the name of the system component and shall provide the following information for the component:

- a. The purpose of the component
- b. A brief description of the component
- c. The system requirements the component must perform

10.4 Paragraph 4, "VERIFICATION"

10.4.1 Paragraph 4.1, "General"

This paragraph shall provide any pertinent introductory material for Section 4 that specifies the requirements for verification of the system requirements specified in Section 3. This section shall not incorporate, either directly or by reference, detail test planning documents or instructions.

10.4.1.1 Paragraph 4.1.1, "Responsibility for Verification"

This paragraph shall specify the organizational responsibilities for performing and supporting verification during the phases enumerated in paragraph 4.2. This paragraph shall include a statement that the Government reserves the right to witness, perform, and verify the results of all verification accomplished.

10.4.1.2 Paragraph 4.1.2, "Verification Method Selection"

This paragraph shall specify the criteria to be used in selecting the verification methods (similarity, analysis, inspection, demonstration, and test) based on such considerations as criticality categories and design margins.

10.4.1.3 Paragraph 4.1.3, "Relationships to Management Reviews"

This paragraph shall be used to describe the technical and management relationships of the verification phases (paragraph 4.2) to planned formal design reviews, e.g., PDR's and CDR's. This description shall include requirements for incorporating into the formal design reviews the status of verification accomplished in accordance with paragraph 4.2.

10.4.1.4 Paragraph 4.1.4, "Test Articles or Test Equipment Failures"

This paragraph shall specify quantitative criteria for reuse, refurbishment, or scrap of test articles or test equipment which have experienced failure. In addition,

the paragraph shall establish criteria for determination of whether test requirements were met prior to failure.

10.4.2 Paragraph 4.2, "Phased Verification Requirements"

This paragraph shall include pertinent introductory material. It shall specify in appropriate subparagraphs each requirement to the level of detail necessary to establish the scope and accuracy of the method.

10.4.2.1 Paragraph 4.2.1, "Qualification"

This paragraph shall specify those verification requirements necessary to demonstrate that the system will meet performance and design requirements under anticipated operational environments.

10.4.2.2 Paragraph 4.2.2, "Acceptance"

This paragraph shall specify those verification requirements necessary to ensure that the system is ready for acceptance by the Government.

10.4.2.3 Paragraph 4.2.3, "Integrated Systems"

This paragraph shall specify those verification requirements necessary to demonstrate that this system, when integrated with other systems, will meet the mission requirements, and that the physical, functional, and operational interfaces are compatible.

10.4.2.4 Paragraph 4.2.4, "Prelaunch Checkout"

This paragraph shall specify those requirements necessary to verify that the system will meet launch requirements.

10.4.2.5 Paragraph 4.2.5, "Flight/Mission Operations"

This paragraph shall specify those requirements that can best be verified during this phase.

10.4.2.6 Paragraph 4.2.6, "Postflight"

This paragraph shall specify those requirements that will verify that the system will meet postflight checkout, maintenance and resupply actions, and schedules.

10.4.3 Paragraph 4.3, "Verification Cross-Reference Index"

This paragraph shall correlate each system requirement of Section 3 to the verification requirements specified in Section 4. See Figure II-3 for suggested format.

10.4.4 Paragraph 4.4, "Test Support Requirements"

This paragraph shall provide pertinent introductory material for subparagraphs.

10.4.4.1 Paragraph 4.4.1, "Test Facilities and Equipment"

This paragraph shall specify requirements and provide for consideration of the following:

- a. Maximum practical utilization of existing facilities and equipment within NASA or other Government agencies or contractors;
- b. Identification of the activation and operation plans that will apply to the identification and control of test facilities, equipment, personnel, procedures, and safety requirements;
- c. Integration of test facilities and equipment requirements used to test the system at more than one location (e.g., at the manufacturing source and at the NASA using site) to ensure uniformity of test results; and
- d. Qualification or certification of all test equipment to ensure that no damage or degradation will be introduced into the system being tested and that the test results shall not include test equipment error.

CSCI Nomenclature/Number	VERIFICATION CROSS-REFERENCE INDEX								Spec. No. _____ Dated _____ Page _____
REQUIREMENTS FOR VERIFICATION									
VERIFICATION METHOD: 1. Similarity 2. Analysis 3. Inspection 4. Demonstration 5. Test					VERIFICATION PHASE: A. Development B. Qualification C. Acceptance D. Integrated Systems E. Prelaunch Checkout F. Flight/Mission Operations G. Postflight				
N/A - Not Applicable									
Section 3.0 Performance/Design Requirement Reference	Verification Methods								Section 4.0 Verification Requirement Reference
	N/A	A	B	C	D	E	F	G	
Enter in sequence all paragraph numbers of Section 3.									Enter paragraph number(s) of Section 4 that contain the verification requirements for each performance and design requirement paragraph listed in the left-hand column.

Figure II-3. Verification Cross-Reference Index

10.4.4.2 Paragraph 4.4.2, "Test Articles"

This paragraph shall specify the requirement for dedicated test article(s) and specify limitations and refurbishment requirements for use of mission items or components for test purposes.

10.4.4.3 Paragraph 4.4.3, "Software"

This paragraph shall specify requirements for specialized test and verification/validation software. Existing software shall be used to the maximum extent possible, and the development of software unique to the needs of a particular system, item, or location shall be minimized.

10.4.4.4 Paragraph 4.4.4, "Interfaces"

Where verification/validation requires interfacing of the system with other systems, facilities, or equipment, the interface requirements shall be specified.

10.5 Paragraph 5, "PREPARATION FOR DELIVERY"

This section shall specify requirements for the preparation of the system and all its components for delivery, including packaging and handling.

10.6 Paragraph 6, "NOTES"

This section shall contain any general information that aids in understanding this document (e.g., background information and glossary). This section shall contain an alphabetical listing of all acronyms, abbreviations, and their meanings as used in this document.

10.7 "APPENDIX"

The appendix or appendices shall contain requirements that are a part of the specification but which, for convenience in document maintenance, are incorporated as an appendix (e.g., tabular or chart form data, requirements of a temporary nature or of limited effectivity). Appendices may be bound as separate documents for convenience of handling (e.g., when only a few parameters of the system are classified, an appendix containing only the classified material may be established). As applicable, each appendix shall be referenced in the main body of the specification in the place where the data would normally have been provided.

10.8 Specification Outline

The following is provided as a suggested outline for the Program/Project/System Specification.

Specification No. _____

Date _____

Page _____

1. SCOPE

1.1 Program/Project/System Overview

1.2 Document Overview

2. APPLICABLE DOCUMENTS

2.1 Government Documents

2.2 Non-Government Documents

3. SYSTEM REQUIREMENTS

3.1 Definition

3.1.1 General Description

3.1.2 Missions

3.1.3 Interface Definition

3.1.4 Operational Concepts

3.1.5 Systems Engineering Requirements

3.1.6 Government-Furnished Equipment/Property List

3.1.7 Critical Components (Items).

3.2 Characteristics

3.2.1 Performance

3.2.1.1 General Performance

3.2.1.n Functional Area Performance

3.2.2 Physical

3.2.3 Reliability

3.2.4 Maintainability

3.2.5 Environmental Conditions

a. Natural

b. Induced

3.2.6 Transportability/Transportation

3.2.7 Operational Availability

3.2.8 Storage

3.3 Design and Construction Standards

3.3.1 General

3.3.2 Materials, Parts, and Processes

3.3.3 Design

3.3.4 Identification and Marking

3.3.5 Workmanship

- 3.3.6 Interchangeability and Replaceability
- 3.3.7 Safety
- 3.3.8 Human Engineering
- 3.3.9 Computer Resources

3.4 Documentation

3.5 Logistics

3.6 Personnel and Training

3.7 Major Components Characteristics

- 3.7.1 First System Component
through
- 3.7.n Nth System Component

4. VERIFICATION AND VALIDATION*

4.1 General

- 4.1.1 Responsibility for Verification and
Validation
- 4.1.2 Verification and Validation Method Selection
- 4.1.3 Relationships to Management Reviews
- 4.1.4 Test Articles or Test Equipment Failures

4.2 Phased Verification and Validation Requirements

- 4.2.1 Qualification
- 4.2.2 Acceptance
- 4.2.3 Integrated Systems
- 4.2.4 Prelaunch Checkout
- 4.2.5 Flight/Mission Operations
- 4.2.6 Postflight

4.3 Verification Cross-Reference Index

4.4 Test Support Requirements

- 4.4.1 Test Facilities and Equipment
- 4.4.2 Test Articles
- 4.4.3 Software
- 4.4.4 Interfaces

5. PREPARATION FOR DELIVERY

6. NOTES

APPENDIX

*NOTE: VALIDATION IS APPLICABLE TO SOFTWARE/FIRMWARE

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Exhibit II Appendix A

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APPENDIX B

SOFTWARE REQUIREMENTS SPECIFICATION

20.0 General

This specification identifies the engineering and qualification requirements for a computer software configuration item (CSCI) and shall be used as the basis for the design and formal testing of a software CSCI. A suggested outline for this specification is provided at the end of this Appendix.

20.1 Section 1, "SCOPE"

This section shall be divided into the following paragraphs:

20.1.1 Paragraph 1.1, "Identification"

This paragraph shall contain the approved identification number, title, and if applicable, abbreviation or acronym of the system and the (CSCI) to which this software requirements specification (SRS) applies.

20.1.2 Paragraph 1.2, "Software CSCI Overview"

This paragraph shall briefly state the purpose of the system and shall identify and describe the role, within the system, of the software CSCI to which the SRS applies.

20.1.3 Paragraph 1.3, "Document Overview"

This paragraph shall summarize the purpose and contents of the document.

20.2 Section 2, "APPLICABLE DOCUMENTS"

The content of Section 2 shall be in accordance with paragraph 10.2 of Appendix A.

20.3 Section 3, "REQUIREMENTS"

This section shall be divided into the following paragraphs and subparagraphs to specify the engineering requirements necessary to ensure proper development of the software CSCI. Requirements to be included herein shall be allocated or derived from requirements established by the applicable system specification or complex item requirements specification.

20.3.1 Paragraph 3.1, "Software CSCI External Interface Requirements"

This paragraph shall identify the external interfaces of the software CSCI. An external interface diagram may be used to aid in this description. Each external interface shall be identified by name and project-unique identifier and a brief description of each interface shall be provided. Any identifying documentation, such as an Interface Control Drawing (ICD) or specification, shall be referenced for each interface.

20.3.2 Paragraph 3.2, "Software CSCI Capability Requirements"

This paragraph shall identify in the following subparagraphs the requirements related to each major capability that the software CSCI must satisfy. If the system (of which the software CSCI is a part) can exist in various system states and modes as documented in the system specification, this paragraph shall identify each state and mode and shall correlate each software CSCI capability to those states and modes. A table may be used to depict this correlation.

Paragraph 3.2.X, "(Capability Name and Project-Unique Identifier)"

These subparagraphs (beginning with 3.2.1) shall identify the software CSCI capability by name and project-unique identifier and shall state the purpose of the capability and its performance in measurable terms. These subparagraphs shall identify and state the purpose of each input and output associated with the capability. These subparagraphs shall identify the allocated or derived requirements that the capability satisfies or partially satisfies. If the capability can be more clearly specified by decomposing it into constituent capabilities, the requirements for each constituent capability shall be provided as one or more subparagraphs. Each constituent capability shall be assigned a project-unique identifier that is derived from the identifier of the parent capability.

20.3.3 Paragraph 3.3, "Software CSCI Internal Interfaces"

This paragraph shall identify the interfaces between the capabilities stated in paragraph 3.2. Each internal interface shall be identified by name and project-unique identifier and a brief description of each interface shall be provided, including a summary of the information transmitted over the interface. Internal interface diagrams depicting data flow, control flow, and other

relevant information may be used to aid in this description.

20.3.4 Paragraph 3.4, "Software CSCI Data Element Requirements"

This paragraph shall specify the following information, as applicable:

a. For data elements internal to the software CSCI:

- (1) Assign a project-unique identifier to the data element.
- (2) Provide a brief description of the data element.
- (3) Identify the units of measure required for the data element, such as seconds, meters, kilohertz.
- (4) Identify the limit/range of values required for the data element (for constants provide the actual value).
- (5) Identify the accuracy required for the data element.
- (6) Identify the precision or resolution required for the data element in terms of significant digits.
- (7) For data elements of the software CSCI's internal interfaces:
 - Identify the interface by name and project-unique identifier;
 - Identify the source capability of the data element by name and project-unique identifier; and
 - Identify the data element's destination capability by name and project-unique identifier.

b. For data elements of the software CSCI's external interfaces:

- (1) Identify the data elements by project-unique identifier.
- (2) Identify the interface by name and project-unique identifier.
- (3) Identify the name and project-unique identifier of the source or destination capability, as applicable.

- (4) Reference the document in which the interface is specified.
- (5) Identify data element transmission frequency and data rate.

20.3.5 Paragraph 3.5, "Adaptation Requirements"

This paragraph shall be divided into the following subparagraphs to specify the requirements for adapting the software CSCI to site-unique conditions and changes in the system environment.

20.3.5.1 Paragraph 3.5.1, "Installation-Dependent Data"

This subparagraph shall describe the site-unique data required by each installation. Examples of such data are site latitude and longitude, radar ranges and areas of coverage, and prescribed safety limits. In addition, this subparagraph shall identify the software CSCI capabilities in which these data are used.

20.3.5.2 Paragraph 3.5.2, "Operational Parameters"

This subparagraph shall describe parameters required by the software CSCI that may vary within a specified range according to operational needs. Examples of such data are allowable trajectory deviations, navigation set model numbers, interaction/isolation of sorties, and vehicle performance characteristics. This subparagraph shall identify the software CSCI capabilities in which these data are used.

20.3.6 Paragraph 3.6, "Sizing and Timing Requirements"

This paragraph shall specify the amount and, if applicable, location of internal and auxiliary memory and the amount of processing time allocated to the software CSCI. This paragraph shall specify the resources required of both memory and the central processing unit (CPU) for the software CSCI.

20.3.7 Paragraph 3.7, "Safety Requirements"

This paragraph shall specify safety requirements that are applicable to the design of the software CSCI, with respect to potential hazards to personnel, property, and the physical environment.

20.3.8 Paragraph 3.8, "Security Requirements"

This paragraph shall specify computer security requirements that are applicable to the design of the software CSCI, with respect to prevention of unauthorized access and use of the system or item.

20.3.9 Paragraph 3.9, "Design Constraints"

This paragraph shall specify other requirements that constrain the software CSCI design, such as the use of a particular processing configuration.

20.3.10 Paragraph 3.10, "Software Quality Factors"

This paragraph shall be divided into subparagraphs, as appropriate, to specify each software quality factor that must be achieved by this software CSCI. For each quality factor required, the method of compliance shall be specified along with the requirements for that factor.

20.3.11 Paragraph 3.11, "Human Performance/Human Engineering Requirements"

This paragraph shall specify the applicable human engineering requirements for the software CSCI. These requirements shall include, as applicable, considerations for:

- a. Human information processing capabilities and limitations;
- b. Foreseeable human errors under both normal and extreme conditions (especially for input, display, control, maintenance, and management of critical information and systems); and
- c. Implications for the total system environment (include training, support, and operational environments).

20.3.12 Paragraph 3.12, "Requirements Traceability"

This paragraph shall contain a mapping of the engineering requirements in this specification to the requirements applicable to this software CSCI in the system or item requirements specification. This paragraph shall also provide a mapping of the allocation of the software CSCI requirements from the system or item requirements specification to the engineering requirements in this specification.

20.3.13 Paragraph 3.13, "Logistics"

This paragraph shall identify requirements for any facilities, equipment, software, and related resources that will be necessary to provide a software support capability for the software CSCI after it has been delivered. If this capability must be integrated with an existing Government capability, this paragraph shall identify the requirements for integrating, and ensuring the compatibility of, the added capability with the existing Government capability. This paragraph shall identify requirements for software supportability, such as the use of particular programming languages; integration with, or use of, existing software support capabilities; the development or delivery of added support resources; and any limitations on the use of any particular support facilities, computer equipment, or software.

20.3.14 Paragraph 3.14, "Government-Furnished Property" (GFP)

This subparagraph shall list all GFP (in this case, the Government-furnished software and/or information) used in the development of this software CSCI.

20.4 Section 4, "VERIFICATION AND VALIDATION"

This section shall be divided into the following paragraphs to specify the verification and validation methods and any special verification requirements necessary to establish that the software CSCI satisfies the requirements of Sections 3 and 5.

20.4.1 Paragraph 4.1, "Verification Methods"

This paragraph shall specify the verification methods for ensuring that the software CSCI requirements of Sections 3 and 5 have been satisfied. A table may be used to present this information. Verification methods include:

- a. Demonstration. The operation of the software CSCI (or some part of the software CSCI) that relies on observable functional operation not requiring the use of elaborate instrumentation or special test equipment.
- b. Analysis. The processing of accumulated data obtained from other qualification methods. Examples are interpretation or extrapolation of test data.
- c. Examination. Visual review of software CSCI code, documentation, etc.
- d. Test. A method of qualification wherein performance is quantitatively measured during or after the

controlled application of real or simulated functional and/or environmental stimuli. The analysis of data derived from a test is an integral part of the test activity and may involve automated data reduction to produce the necessary results.

20.4.2 Paragraph 4.2, "Special Verification Requirements"

This paragraph shall be divided into appropriate subparagraphs to specify special requirements associated with verification of the software CSCI. This paragraph shall identify and describe, if applicable, special tools, techniques (e.g., test formulas, algorithms), procedures, facilities, and acceptance limits. For each special test, the following information shall be specified:

- a. A project-unique identifier for the test;
- b. The paragraph number(s) of the capability requirement(s) to which the test applies;
- c. A description of the test, e.g., a 24-hour peak-load stress test; and
- d. The level of the test (unit, component, software CSCI, or system level).

20.5 Section 5, "PACKAGING"

This section shall specify the type and characteristics of the delivery media of data, as well as the operational media, for the software CSCI (e.g., 8 track magnetic tape with 1600 bits per inch, 150 megabyte disk). In addition, this section shall specify the labeling, packaging, handling, and classification marking requirements for the media, including the software CSCI name and project-unique identifier. Any unique delivery requirements shall also be specified in this section.

20.6 Section 6, "NOTES" (See 4.6 of Table II-1.)

20.7 "APPENDIX" (See 4.7 of MIL-STD-490A.)

20.8 Specification Outline

The following is provided as a suggested outline for the Software Requirements Specification.

Specification No. _____

Date _____

Page _____

1. SCOPE
 - 1.1 Identification
 - 1.2 Software CSCI Overview
 - 1.3 Document Overview
2. APPLICABLE DOCUMENTS
3. REQUIREMENTS
 - 3.1 Software CSCI External Interface Requirements
 - 3.2 Software CSCI Capability Requirements
 - 3.2.X (Capability Name and Project-Unique Identifier)
 - 3.3 Software CSCI Internal Interfaces
 - 3.4 Software CSCI Data Element Requirements
 - 3.5 Adaptation Requirements
 - 3.5.1 Installation-Dependent Data
 - 3.5.2 Operational Parameters
 - 3.6 Sizing and Timing Requirements
 - 3.7 Safety Requirements
 - 3.8 Security Requirements
 - 3.9 Design Constraints
 - 3.10 Software Quality Factors
 - 3.11 Human Performance/Human Engineering Requirements
 - 3.12 Requirements Traceability
 - 3.13 Logistics
 - 3.14 Government-furnished Property
4. VERIFICATION AND VALIDATION
 - 4.1 Verification/Validation Methods
 - a. Demonstration
 - b. Analysis
 - c. Examination
 - d. Test
 - 4.2 Special Verification/Validation Requirements

5. PACKAGING

6. NOTES

APPENDIX

APPENDIX C

SOFTWARE INTERFACE REQUIREMENTS SPECIFICATION

30.0 General

This specification identifies the requirements for one or more interfaces between one or more computer software configuration items (CSCI's) and other contract end items (CEI's) or critical items. A suggested outline for this specification is provided at the end of this Appendix.

30.1 Section 1, "SCOPE"

This section shall be divided into the following paragraphs.

30.1.1 Paragraph 1.1, "Identification"

This paragraph shall contain the approved identification number and title of the interface(s) to which this software interface requirements specification (SIRS) applies.

30.1.2 Paragraph 1.2, "System Overview"

This paragraph shall briefly state the purpose of the system and shall identify and describe the role, within the system, of the interfaces to which this SIRS applies.

30.1.3 Paragraph 1.3, "Document Overview"

This paragraph shall summarize the purpose and contents of this document.

30.2 Section 2, "Applicable Documents"

(See paragraph 10.2 of Appendix A.)

30.3 Section 3, "Requirements"

This section shall be divided into the following paragraphs and subparagraphs to specify the requirements for those interfaces to which this SIRS applies.

30.3.1 Paragraph 3.1, "Interface Diagrams"

This paragraph shall identify the interfaces among the software and hardware CSCI's and Critical Items to which this specification applies. One or more interface diagrams, as appropriate, shall be provided to depict the

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interfaces. Each interface shall be identified by name and project-unique identifier.

30.3.2 Paragraph 3.2 through 3.n, "Interface Name and Project-Unique Identifier"

This paragraph shall identify interface(s) by name and project-unique identifier and shall state its purpose. This paragraph shall be divided into the following subparagraphs to specify the requirements for the interface and for the data transmitted across the interface.

30.3.2.1 Paragraphs 3.2.1 through 3.n.1, "Interface Requirements"

This subparagraph shall specify the following, as applicable:

- a. Whether the interfacing software CSCI's are to execute concurrently or sequentially. If concurrently, the method of inter-CSCI synchronization to be used;
- b. The communication protocol to be used for the interface; and
- c. The priority level of the interface.

30.3.2.2 Paragraphs 3.2.2 through 3.n.2, "Data Requirements"

This paragraph shall specify, in a data element definition table similar to Table II-3, the following information, as applicable, for each data element transmitted across the interface:

- a. A project-unique identifier for the data element;
- b. A brief description of the data element;
- c. The CSCI or critical item that is the source of the data element;
- d. The CSCI's or critical item(s) that are the users of the data element;
- e. The units of measure required for the data element, such as seconds, meters, kilohertz;
- f. The limit/range of values required for the data element (for constants provide the actual value);
- g. The accuracy required for the data element; and
- h. The precision or resolution required for the data element in terms of significant digits.

30.4 Section 4, "Quality Assurance"

This section shall state "NONE."

Table II-3. Example of an Interface Data Element Definition Table

IDENTIFIER	DESCRIPTION	SOURCE CSCI	DESTINATION	UNIT OF MEASURE	LIMIT/RANGE	ACCURACY	PRECISION RESOLUTION
IFA001	VELOCITY	CSCI-A	CSCI-B CSCI-C	ft/sec	20-1000	+20	10 ⁻³
IFA002	AZIMUTH	CSCI-A	CSCI-D	RADIANS	0 - $\pi/2$	_0.05	10 ⁻³
IFA003	ALTITUDE	CSCI-C	CSCI-A CSCI-B CSCI-D	ft	0-1500	+10	10 ⁻²

30.5 Section 5, "Preparation for Delivery"

This section shall state "NONE."

30.6 Section 6, "Notes"

This section shall contain any general information that aids in understanding this document (e.g., background information, glossary). This section shall include an alphabetical listing of all acronyms, abbreviations, and their meanings as used in this document.

30.7 Section 7, "Appendix"

(See paragraph 4.7 of MIL-STD-490A.)

30.8 Specification Outline

The following is provided as a suggested outline for the Software Interface Requirements Specification.

Specification No. _____

Date _____

Page _____

1. SCOPE1.1 Identification1.2 System Overview1.3 Document Overview

2. APPLICABLE DOCUMENTS

3. REQUIREMENTS

3.1 Interface Diagrams

3.n. Interface Name and Project-Unique Identifier

3.2.1 Paragraphs 3.2.1
through

3.n.1. Interface Requirements

3.2.2 Paragraphs 3.2.2
through

3.n.2. Data Requirements

4. QUALITY ASSURANCE

5. PREPARATION FOR DELIVERY

6. NOTES

APPENDIX

APPENDIX D

SOFTWARE PRODUCT SPECIFICATION

40.0 General

This specification consists of the software design document and the source code listings for a computer software configuration item (CSCI). A suggested outline for this specification is provided at the end of this Appendix.

40.1 Section 1, "SCOPE"

This section shall be divided into the following paragraphs.

40.1.1 Paragraph 1.1, "Identification"

This paragraph shall contain the approved identification number, title, and abbreviation, if applicable, of the software CSCI and the system to which this software product specification applies.

40.1.2 Paragraph 1.2, "System Overview"

This paragraph shall briefly state the purpose of the system and the software CSCI to which this specification applies.

40.1.3 Paragraph 1.3, "Document Overview"

This paragraph shall summarize the purpose and contents of the document.

40.2 Section 2, "APPLICABLE DOCUMENTS"

(See paragraph 10.2 of Appendix A.)

40.3 Section 3, "REQUIREMENTS"

This section shall be divided into the following paragraphs to contain, or reference the appendices that contain, all design documentation and listings applicable to the software CSCI.

40.3.1 Paragraph 3.1, "Software Design"

This paragraph shall contain, or reference the appendix or other document that contains, the software design document.

40.3.2 Paragraph 3.2, "Software CSCI Source Code Listings"

This paragraph shall contain, or reference the appendix that contains, the source code listings of the software CSCI. This paragraph shall provide an index that cross-references each software component and software unit to the location in the source code listings where they are found.

40.3.3 Paragraph 3.3, "Compiler/Assembler"

This paragraph shall specify the exact version of the compiler, linker, and loader programs, and, if applicable, the assembler used to translate the source code.

40.3.4 Paragraph 3.4, "Measured Resource Utilization"

This paragraph shall specify the measured resource utilization, compilation cycle time, and size of components and units of the software CSCI at the time of delivery.

40.4 Section 4, "VERIFICATION AND VALIDATION"

This section shall specify the requirements to verify that the produced software matches the master program.

40.5 Section 5, "PACKAGING"

(See MIL-STD-490A, Section 4.5.)

40.6 Section 6, "NOTES"

This section shall contain any general information that aids in understanding this specification (e.g., background information, glossary, formula derivations). This section shall include an alphabetical listing of all acronyms, abbreviations, and their meanings as used in this document (see MIL-STD-490A, Section 4.6).

40.7 Appendices

The software product specification shall incorporate the following appendices, as applicable.

40.7.1 Appendix A, "Software Design"

This appendix shall contain the software design document if that document is not contained in paragraph 3.1 or in another referenced document.

40.7.2 Appendix B, "Source Code Listings"

This appendix shall contain the source code listings of the software CSCI if the listings are not contained in paragraph 3.2.

40.7.3 Appendix C, "Interface Design"

This appendix shall contain the interface design document if that document is not contained in paragraph 3.1 or in another referenced document.

40.8 Specification Outline

The following is provided as a suggested outline for the Software Product Specification.

Specification No. _____

Date _____

Page _____

1. SCOPE

1.1 Identification

1.2 System Overview

1.3 Document Overview

2. APPLICABLE DOCUMENTS

(See 10.2 of Appendix A.)

3. REQUIREMENTS

3.1 Software Design

3.2 Software CSCI Source Code Listings

3.3 Compiler/Assembler

3.4 Measured Resource Utilization

4. VERIFICATION AND VALIDATION

5. PACKAGING

6. NOTES

APPENDICES

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Exhibit II Appendix D

Appendix A Software Design

Appendix B Source Code Listings

Appendix C Interface Design

APPENDIX E

ADDENDA TO CONTRACT-END-ITEM DETAIL SPECIFICATIONS

50.0 ADDENDA TO CONTRACT-END-ITEM DETAIL SPECIFICATIONS

50.1 ADDENDA FORMAT AND CONTENT

50.1.1 The use of a specification addendum presents a formal means of writing a specification for a new Contract-End-Item (CEI) by changing the specification for an existing CEI in a manner which permits ready comparison of the exact relationship between items of equipment. An addendum specification shall be prepared using one of the following methods:

- a. Make a direct reference to the existing specification on a paragraph-by-paragraph basis. The applicability of each paragraph shall then be stated by deleting, revising, or stating "no change."
- b. Make a direct reference to the existing specification as being generally applicable with noted exceptions. Each exception shall be stated in the form of an addition, deletion, or revision affecting specific portions of the existing specification.

The paragraph numbering between the two documents will be identical, with the exception of paragraphs added to the new document which do not have an exact counterpart in the existing specification.

50.1.2 A specification created in this manner is a new and complete specification in every sense. The method of preparing a specification for a new CEI by creating an addendum to an existing specification shall be used when the following considerations are satisfied:

- a. There is sufficient reason to establish direct relationship between the new CEI and an existing CEI as a basis for design and development; e.g., progressing from one type, model, series of a CEI to another.
- b. The basic specification, to which the addendum is prepared, complies with the requirements of Exhibit II, with respect to format and contents.

50.1.3 The specification created by use of an addendum must be identified and maintained as a separate specification. Both the specification created by use of an addendum and the basic specification to which the addendum is prepared shall have independent change cycles.

- 50.1.4 A Specification Change Notice (SCN) to either specification is not automatically a change to both. Each change to either must be reviewed; to change both the basic specification and the specification prepared as an addendum, two separate SCN's must be prepared.
- 50.1.5 When a new specification is created by the preparation of an addendum to an existing specification, an "Addendum Notice" shall be prepared which conforms to the format and includes the content required by Figure II-4. The basic specification shall be the first entry in Section 2, "APPLICABLE DOCUMENTS", of the addendum specification. The data in the Addendum Notice shall be transcribed from the title page and Specification Change Instruction (SCI) of the basic specification.
- 50.1.6 For filing and distribution, an addendum specification must always be accompanied by the specification to which it relates.

--- ADDENDUM NOTICE ---

This specification has been prepared as an addendum to:

Specification No. _____
Revision _____
Release Date _____
CEI No. _____

FOR

(Approved Nomenclature)

Used With

(PROJECT NAME) (PROGRAM)

This addendum specification must always be accompanied by the specification (above) to which it relates.

The exact content of Specification (insert same number as above) used as the basic document for this Addendum is the revision referenced above plus the following Specification Change Notices to Specification (insert same number as above).

Figure II-4. Addendum Notice Format

EXHIBIT III
INTERFACE CONTROL PRACTICESTABLE OF CONTENTS

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EXHIBIT III

INTERFACE CONTROL PRACTICES

1.0 PURPOSE

This exhibit provides uniform practices for implementation of interface control management requirements. The intent of this exhibit is to establish requirements that ensure all Contract-End-Item (CEI) interfaces are addressed.

2.0 SCOPE

This exhibit provides guidance in the control of physical, functional, and procedural interfaces between systems, separate system elements, or CEI's which are being developed by or procured from separate contractors and/or agencies.

3.0 REQUIREMENTS3.1 Initial Interface Baseline Establishment3.1.1 Contractor Developed and Maintained Interface Documents

- a. When designated as an interface document custodian, the contractor shall be responsible for initial preparation of Interface Requirements Documents/Interface Control Drawings (IRD's/ICD's). IRD's shall comply with the format for specifications (see Exhibit II) and shall specify basic performance requirements that must be defined for visibility and control. ICD's shall comply with the requirements for interface control drawings specified in industry standard ASME Y14.24 and shall record quantified design interfaces between participating contractors and/or Government agencies.
- b. The contractor shall be responsible for technical coordination with other parties involved with the interface. The contractor shall provide periodic status of this coordination activity and shall advise MSFC of any design, operational, or procedural differences, including recommended resolution, between interfacing parties.
- c. The proposed initial interface document baseline shall be submitted by an Engineering Change Proposal (ECP). ECP submission requirements are contained in Exhibit V. MSFC approval of the ECP will be authority for release and distribution of the interface documents.

3.1.2 Other Activity Developed and Maintained
Interface Documents

When not designated as interface document custodian, the contractor shall review proposed IRD's/ICD's from other interfacing contractors and/or agencies. Upon receipt of proposed IRD's/ICD's, the contractor shall assess impact, coordinate as necessary and take one of the following actions:

- a. If the interface document is a contractual requirement and is compatible with the contractor's detailed design, submit a Record ECP (RECP) in accordance with implementing instructions for processing changes as described in Exhibit V.
- b. If the interface document is not a contractual requirement, but is compatible with the contractor's detailed design, submit an ECP with SCN's incorporating the IRD/ICD in the development specification CEI documentation in accordance with implementing instructions for processing changes as described in Exhibit V.
- c. If the interface document is incompatible with the contractor's detailed design, submit an ECP identifying required changes in accordance with implementing instructions for processing changes as described in Exhibit V.

3.2 Interface Change Control

Following IRD/ICD baseline establishment, any changes affecting the IRD/ICD shall be considered a Class I change. Changes to an IRD/ICD shall be accomplished by total document revision or by changes to specifically identified portions of the document.

3.2.1 IRD/ICD Revision

Interface document revision involves the total re-issuance of the document and shall be accomplished only to incorporate approved Interface Revision Notices (IRN's). Unless otherwise directed, ICD's shall be revised any time there are seven outstanding IRN's. The revised document shall be submitted for approval in the same manner prescribed for the initial submission.

3.2.2 IRD/ICD Changes

- a. When a contractor desires, or is directed by MSFC to make a change to an interface document, the proposed change shall be documented as a Preliminary Interface

Revision Notice (PIRN). MSFC Form 4229 and 4229-1, Interface Revision Notice, with instructions and Continuation Sheet, shown in Figures III-1, III-1a, and III-1b, or equivalent formats, shall be used. The PIRN shall be submitted by an ECP and submitted in accordance with implementing instructions for processing changes as described in Exhibit V.

- b. Proposed interface document changes initiated by other activities and submitted for contractor review and evaluation shall require coordination and response in accordance with implementing instructions for processing changes as described in Exhibit V.
- c. A Record ECP shall be used to document a contractor's concurrence with a proposed change to an ICD initiated by another contractor or MSFC. In cases of nonconcurrence, an ECP describing the changes required to comply with the proposed interface changes, shall be submitted.
- d. For engineering changes that affect only ICD's (there is no impact to any specification referencing the ICD), an SCN is not required to reflect the approval of the IRN or revision to the ICD.
- e. In those cases where agreement cannot be reached during a review of a PIRN, the contractor shall submit an alternate PIRN submitted by an ECP to MSFC for consideration and disposition.

Interface Revision Notice

1. AFFECTED ICD NO. & REV.:		2. PIRN NO.:		3. IRN NO.:		4. SHEET 1 of	
5. PROGRAM:				6. PCN:		7. PANEL AFFECTED:	
8. ICD TITLE:							
9. EFFECTIVITY(IES):				10. REASON FOR CHANGE:			
CHANGE ICD EFFECTIVITY		11. TO:			12. FROM:		
13. IRN NO.:		14. NEW IRN EFFECTIVITY:			15. PREVIOUS IRN EFFECTIVITY:		
16. DESCRIPTION OF CHANGE:							
17. PREPARED BY:		18. ORG:		19. DATE:		20. CONCURRENCE:	
21. CONCURRENCES							
SIGNATURE		ORG	DATE	SIGNATURE		ORG	DATE
22. APPROVALS							
	APPROVAL & ACTIVITY	DATE	APPROVAL & ACTIVITY	DATE	APPROVAL & ACTIVITY	DATE	

Figure III-1. MSFC Form 4229, Interface Revision Notice

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Exhibit III

Interface Revision Notice

Complete all applicable blocks. If needed, continuation sheets may be used. The Preliminary IRN should be of sufficient quality so that, if approved, it may be released to the ICD custodian and/or the MSFC Repository for reproduction and distribution. The following instructions are keyed to the numbers on the form.

1. **AFFECTED ICD NO. & REV.** Enter the complete number and revision of the ICD affected by the PIRN.
2. **PIRN NO.** Enter an organizational tracking number for identification until an IRN number is assigned, and the PCN (if assigned) of the basic change action.
3. **IRN NO.** Leave blank. To be completed by CCB secretary. (IRN number will be assigned only after approval of the proposed change.)
4. **SHEET 1 of ____** Enter total number of sheets.
5. **PROGRAM** Enter the applicable program; e.g., SEDS-2, AADSF, etc.
6. **PCN** Enter the PCN (if assigned) of the basic change action.
7. **PANEL AFFECTED** Enter the identification of the IWG or other organization controlling the ICD.
8. **TITLE** Enter the exact title of the affected ICD.
9. **EFFECTIVITY(IES)** Enter the effectivity(ies) of the change described by the PIRN, including launch vehicle elements, upper stages, payloads, experiments, etc., as appropriate.
10. **REASON FOR CHANGE** Enter a brief statement of the reason for the change and include related ECP number.
11. **CHANGE ICD EFFECTIVITY TO** Leave blank except when this PIRN is used to change the effectivity of the ICD.
12. **CHANGE ICD EFFECTIVITY FROM** Leave blank except when this PIRN is used to change the effectivity of the ICD.
13. **IRN NO.** Leave blank except when this PIRN is used to change the effectivity of a previous IRN.
14. **NEW IRN EFFECTIVITY** Leave blank except when this PIRN is used to change the effectivity of a previous IRN.
15. **PREVIOUS IRN EFFECTIVITY** Leave blank except when this PIRN is used to change the effectivity of a previous IRN.
16. **DESCRIPTION OF CHANGE** Enter the proposed change to the affected ICD for all sides of the affected interfaces, using continuation sheets if required.
17. **PREPARED BY** Enter the name of the engineer preparing the PIRN.
18. **ORGANIZATION** Enter the name of the preparing organization.
19. **DATE** Enter the date prepared.
20. **CONCURRENCE** Enter the name of the engineering manager concurring in the PIRN.
21. **CONCURRENCES** Leave blank. These fields are to be used to record technical acceptance by the authorized representatives of the interfacing activities or recognized IWG.
22. **APPROVALS** These fields are to be used to identify the applicable CCB and record their approval.

Figure III-1a. MSFC Form 4229 (Reverse Side)
Interface Revision Notice Instructions

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Exhibit III

Interface Revision Notice - Continuation Sheet

1. AFFECTED ICD NO. & REV.:	2. PIRN NO.:	3. IRN NO.:	4. SHEET__ OF
	6. PCN:		
16. DESCRIPTION OF CHANGE:			

MSFC Form 4229-1 (January 1994)

Computer Generated

Figure III-1b. MSFC Form 4229-1, Interface Revision Notice
Continuation Sheet

3.3 Interface Designation on Associated Documentation

Documentation affecting any interface requires interface control management coordination and action. The following statement shall be entered on the first sheet of the document immediately above the title block:

"This drawing/document contains information controlled by an IRD/ICD. No changes shall be made to information controlled by an IRD/ICD prior to interface control management authorization."

NOTE: MIL-STD-100 and certain programs may dictate similar, but different marking notations. Variations are authorized when contractually specified.

3.4 ICD Contractual Index and Status Report

The ICD Contractual Index and Status Report, issued periodically by MSFC, is a summary of contractual revisions and IRN's to baselined ICD's listed by CEI effectivity. As contractually required, the contractor shall review the report, redline necessary changes, and return the document to MSFC.

3.5 IRD/ICD Identification in CEI Specifications

References to IRD/ICD's in CEI specifications shall be as follows:

- a. Section 2, "Applicable Documents." The following statement shall be inserted in lieu of a list of ICD's: "Latest applicable revisions of ICD's and IRN's to ICD's are listed in the latest contractual issue of the MSFC ICD Contractual Index and Status Report."
- b. Section 3, "Requirements." ICD's shall be referenced without indication of revision or latest approved IRN's.

EXHIBIT IV
CONFIGURATION IDENTIFIERS

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EXHIBIT IV

CONFIGURATION IDENTIFIERS

1.0 PURPOSE

This exhibit provides MSFC contractors with the detailed requirements for assigning and controlling configuration identifiers.

2.0 SCOPE

This exhibit covers requirements for the assignment and use of numbers and other identifiers in the configuration identification, control, and accounting of all (hardware, software, firmware) Contract-End-Items (CEI's), related equipment, and associated documentation. The types of identification numbers covered by this exhibit are as follows:

- a. Document identification numbers
- b. Identification numbers
- c. Software identifiers
- d. Serial and lot numbers
- e. Design activity (Commercial and Government Entity)
CAGE Code

3.0 REQUIREMENTS

3.1 General

The contractor shall assign and control configuration identifiers in accordance with this exhibit.

3.1.1 Identifiers Assigned by Other Design Activities

Where the CEI incorporates the design of a Government agency or of another contractor, subcontractor, vendor or supplier, the contractor shall use identifiers assigned by these design activities without re-identification, except as authorized by MSFC.

3.1.2 Use of Additional Identifiers

The contractor shall not use identifiers other than those described in this exhibit for configuration management purposes. Examples of types of identifiers not to be used include the following:

- a. Registration numbers assigned by the Government;
- b. Government-assigned type designations for the CEI;
- c. Other reference designations; e.g., aero numbers, used by the Government;
- d. National stock numbers assigned for inventory control;
- e. Manufacturing or production line numbers used by the contractor to denote manufacturing sequence;
- f. Synthetic part numbers used by the contractor to denote a subassembly of manufacture not covered by an engineering assembly drawing; and
- g. Material codes used for material control.

3.2 Identification Numbers

3.2.1 Specifications

The contractor shall identify specifications, specification revisions, and specification changes in accordance with Exhibit II. These numbers shall uniquely identify all specifications required to control the design, fabrication, and test of hardware and computer software items under MSFC contracts.

3.2.1.1 Exception to MIL-STD-490A Identification Requirements

The specification number shall not exceed 15 character spaces.

3.2.1.2 Government or Industry Specification Numbers

The contractor shall not apply further identification to Government or industry specifications or standards unless the specifications or standards are altered.

3.2.1.3 Specification Identification Number Records

The contractor shall develop and maintain a record of all contractor-prepared specifications, including the revision level and SCN status.

3.2.2 Drawing and Part Numbers

The drawing and part number is assigned to identify, in common, all parts and assemblies, interchangeable or non-interchangeable. The prime function of a part number is

to provide unique part identification which permits control of assembly and replacement at all levels.

3.2.2.1 Assignment of Drawing and Part Numbers

Drawing and part numbers, for other than standards, shall be assigned in accordance with the requirements in MIL-STD-100.

3.2.2.2 Changing Drawing and Part Numbers

Prior to initial engineering release of a part drawing, for incorporation of that part on the first formally accepted unit of a CEI family, engineering changes may be documented and incorporated by drawing change letter control only. Thereafter, drawing change letter control shall continue and part numbers shall be controlled and changed in accordance with requirements of MIL-STD-100 and those below:

- a. When a material, process, or protective treatment is changed to the extent that the conditions specified in MIL-STD-100 change, the part number shall be changed to reflect the new conditions.
- b. When a part, component, or subassembly is reworked into a later number version, and is completely interchangeable with all items identified by the later number, the part shall be re-identified to the number of the later version.
- c. The contractor may establish a part or component, for which the contractor is the design activity, as a company standard identified by a standard specification identification number when all of the following criteria apply:
 - (1) It has a multiple usage and is expected to have a design application in more than one CEI.
 - (2) It is non-repairable (throw away) and will not be provisioned under the contract below the level identified by the standard specification identification number.
 - (3) It is completely specified in a specification document or source control drawing with respect to performance, durability, reliability, form, fit, qualification, and inspection requirements.
 - (4) Unless otherwise concurred in by MSFC, one or more alternate sources are approved and qualified to supply the item.

3.2.3 CEI Numbers

The contractor shall assign a CEI identification number at the time the CEI specification number is assigned or the first production drawing for the CEI is released, whichever occurs first. The CEI number is a permanent number assigned to identify all units comprising one family (type-model-series). Once assigned, it shall not be reassigned to another type, model, and/or series.

3.2.4 Software Identifiers

The contractor shall assign or obtain a software identifier for each computer software configuration item (CSCI) and designated components or units. The software identifier shall consist of the nomenclature, number, CAGE code, and a version identifier. MIL-STD-100 provides information on requirements for identifying software and software documentation. The contractor shall embed the software and version identifiers within the source code and provide a method for display of software and version identifier data to the user upon command.

3.2.5 Serial Numbers

3.2.5.1 General

The contractor shall assign serial numbers to all complete units of a CEI and to critical parts and components. The contractor shall record and maintain serial numbers assigned by subcontractors and suppliers/vendors.

3.2.5.2 CEI Serial Numbers

CEI serial numbers shall not exceed ten characters with the last three characters being numerals assigned in an unbroken numerical progression. They shall be the only serial numbers used for unit identification and engineering effectivity. The contractor shall record serial numbers on all applicable manufacturing records and configuration accounting records for each item.

3.2.5.3 Critical Parts and Components (Items) Serial Numbers

When serialization is required, serial numbers shall be permanently assigned in numerical sequence for a particular part number and shall not be changed even though the component, assembly, or part has been identified by a new part number. The serial number shall be applied to the part in accordance with MIL-STD-130 and

shall be recorded on all manufacturing records and configuration accounting records.

3.2.6 Lot Numbers

3.2.6.1 General

A lot number is a unique number assigned to items that have been fabricated from a particular batch of material, have undergone a particular process, or have been manufactured/tested in a group with each item in the group having an identical history. For items meeting the above criteria and which are not serialized, the contractor shall assign lot numbers to contractor-developed and fabricated items and shall maintain lot numbers assigned by suppliers.

3.2.6.2 Recording of Lot Numbers

The contractor shall record lot numbers on all manufacturing records and configuration accounting records. In addition, the contractor shall develop and maintain a utilization list that cross-references the item, component, or part lot number to the next higher assembly to ensure traceability of lot numbers incorporated into next higher assemblies.

3.2.7 Commercial and Government Entity (CAGE) Code

The contractor shall use CAGE codes as specified in DOD Cataloging Handbook H4/H8.

EXHIBIT V

CHANGE PROPOSAL CONTENT AND SUBMITTAL REQUIREMENTS

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EXHIBIT V

CHANGE PROPOSAL CONTENT AND SUBMITTAL REQUIREMENTS

1.0 PURPOSE

This exhibit provides MSFC contractors with detailed requirements and instructions for the preparation and submittal of change proposals.

2.0 SCOPE

This exhibit covers the preparation and submittal requirements for Engineering Change Proposals (ECP's), Project Change Proposals (PCP's), and Field Engineering Changes (FEC's). The requirements contained in this exhibit apply to all MSFC contracts involved in the design, development, or fabrication of configuration controlled items. Any exception to or deviation from these requirements must be approved by the responsible project or contract management officials. The implementation of these requirements shall be documented in the contractor's Configuration Management (CM) plan.

3.0 REQUIREMENTS3.1 Engineering Change Proposal

An ECP must be used to submit configuration identification documentation that describes a proposed Contract-End-Item (CEI) baseline and to submit proposed Class I changes against the engineering requirements of a baselined CEI. Prior to ECP submittal, the contractor shall obtain a Program Control Number (PCN) for each ECP, as defined in paragraph 3.3.4 of the basic portion of this document.

3.1.1 ECP Types

The type of ECP appropriate to the circumstances shall be selected in accordance with the following definitions.

3.1.1.1 Preliminary ECP

A preliminary ECP may be submitted prior to the availability of the information necessary to support a formal ECP for one of the following reasons:

- a. To permit a preliminary evaluation of its merits and the resources required to further develop a formal proposal;

- b. To permit a preliminary choice of one of various alternate proposals; and
- c. To facilitate early contractual coverage for changes that require study before a formal ECP can be submitted. Documentation of such studies may be submitted in the form of sketches, reports, "redlined" drawings, specifications, or other documentation, but shall not be revised on the basis of the preliminary ECP authorization.

3.1.1.2 Formal ECP

The formal ECP provides engineering and other data in sufficient detail to support formal change approval and contractual authorization.

3.1.1.3 Compatibility ECP

The compatibility ECP is used for submitting changes which are necessary to make the CEI meet the requirements of the baselined specification. The compatibility ECP is limited to those situations in which an engineering change is required to correct a design deficiency. The compatibility ECP is considered to be within the scope of existing contractual coverage.

3.1.1.4 Record ECP

The Record ECP (RECP) shall be used to formally document the contractor's concurrence with proposed or actual documentation changes (PIRN, IRN, SCN, DCN, etc.), initiated by a Government activity or associated contractor. The contractor's submittal of an RECP indicates acceptance of the change as written with no impact to cost, schedule, hardware, and/or software/firmware.

3.1.2 Format and Preparation Instructions

Format and preparation instructions for ECP's are dependent on the type of ECP and the required response time as follows:

- a. Preliminary, formal, and compatibility ECP's shall be prepared in accordance with the format and the instructions of Appendix A to this exhibit. When expedited action is required, the requirements set forth in paragraph 3.1.5 shall apply.
- b. Record ECP's shall be prepared in accordance with the format and instructions of Appendix B to this exhibit.

3.1.3 ECP Identification Numbering Requirements

The contractor shall assign a unique identification number to each ECP. The ECP number shall consist of a basic ECP serial number and, when necessary, a dash number, a suffix code, and a revision code. Requirements for these ECP identification number elements are as follows:

- a. ECP serial numbers shall be assigned sequentially to each separate ECP processed against the CEI(s) covered by the contracted activity.
- b. The dash number shall be used to identify related changes to the contractor's other CEI's which are affected by the same ECP. Each separate CEI affected shall result in a unique dash number being assigned to the related ECP affecting that CEI.
- c. A suffix code shall be assigned to designate the ECP type or condition as follows:

<u>Type</u>	<u>Code</u>
Preliminary	P
Formal	F
Compatibility	C
Expedited	E

The suffix code may be changed to reflect a new condition or a change in the type of ECP. If appropriate, suffix codes may be combined to reflect dual status of the change (e.g., Formal Compatibility would be CF, or Expedited Compatibility would be CE).

- d. The contractor shall assign an ECP revision code to designate that an ECP has been changed/revised. The revised code shall consist of the letter "R" followed by a sequential number which shall be incremented with each subsequent change to the ECP (e.g., R1, R2).

3.1.4 Submittal

3.1.4.1 General

The contractor shall submit all Class I and II engineering changes originated by contractor organizations or subcontractors in accordance with contract requirements and instructions. Class I engineering changes shall also contain project control

considerations (e.g., cost estimates, schedule impact). The distribution and number of copies will be determined

by contract data requirements. Each change that involves related changes on other items or facilities for which the same contractor is responsible shall be presented as a total package for contractual implementation. These related changes shall be identified by dash numbers assigned in accordance with paragraph 3.1.3. An ECP revision letter shall not be used to identify related changes for separate items. A separate ECP shall be submitted for each change that has its own distinct objective. A single ECP shall not cover unrelated changes.

3.1.4.2 Submittal of Supporting Data

Each ECP shall include all necessary supporting data to provide for complete evaluation and understanding of the total impact of the change. Examples of supporting data include engineering, production, maintenance, supply support, contractual, and fiscal data. If an ECP changes the requirements of any baseline documentation, the ECP shall also include all associated changes to that documentation.

3.1.4.3 Submittal of Classified Material

The contractor shall submit any necessary classified material separately in accordance with the contract security requirements and reference that material in the unclassified portion of the ECP.

3.1.5 Expedited Class I Changes

3.1.5.1 General

Changes requiring expedited action (emergency or urgent) shall be processed and submitted by the most expedient means (e.g., electronic transmission, personal delivery). Oral communication shall be confirmed by written message within 24 hours. Written submissions shall use the ECP format, completing appropriate entries based on available information, e.g., any available copies of sketches, marked-up drawings, or preliminary Engineering Orders (EO's) that further clarify the proposed change. An updated and complete formal ECP shall be prepared and submitted to MSFC within 30 days of the initial communication and shall carry the same ECP number assigned to the expedited message. The ECP shall provide the following information:

- a. Identification of the original communication
- b. Individuals contacted
- c. Method of communication
- d. Sources from which contractual direction was received (if appropriate)

An ECP processed in a routine manner in the contractor's plant shall not be upgraded to expedited at the time of submission to MSFC.

3.1.5.2 Compatibility Engineering Change Proposals

Compatibility ECP's requiring expedited action shall identify the one effectivity involved and the serial number identity of the item(s) on which the necessity of the change was discovered. The contractor shall notify the Government by written message within 48 hours after determining that a compatibility change is necessary and shall identify factors that will be impacted, including estimated costs and schedules. Unless otherwise prohibited by the contract, corrective action may then be implemented immediately by the contractor to resolve such incompatibilities, but only for the specific item(s) identified. If further corrective action is necessary prior to formal ECP submission, the contractor shall provide serial number identity of the items for which engineering release and procurement action is proposed. The contractor shall also provide justification of lead time requirements and shall request expedited authorization for these additional serial numbered items. The formal ECP shall identify the total effectivity including applicable serial number identity of all items involved.

3.1.6 Approval of Engineering Changes

3.1.6.1 Class I Engineering Changes

The receipt of contractual approval shall constitute the sole authority for the contractor to implement a Class I engineering change, except for a compatibility change as specified in paragraph 3.1.5.2.

3.1.6.2 Class II Engineering Changes

Normally, the only MSFC review of Class II changes is for concurrence in classification. The contractor shall submit a Class II change concurrently with, or prior to, release of the change within the contractor's plant. The

contractor's Class II change documentation shall contain a provision for MSFC to indicate acceptance or rejection of the change classification.

3.1.7 Revisions to ECP's

3.1.7.1 Prior to Approval or After "Approval As Written"

Any change to an ECP, except minor editorial changes, shall require submittal of a revision to the ECP.

3.1.7.2 After "Approval with Changes"

When MSFC approves an ECP with changes, the contractor shall take one of the following actions:

- a. In the case of concurrence with the changes, submit a revised ECP which reflects the exact changes approved. All engineering documentation released as a result of the "approved with change" ECP shall reference the revised ECP.
- b. In the case of disagreement with the changes, submit written notification of the disagreement, with justification, within 15 working days of receipt of the "approved with change" ECP. The contractor and MSFC will establish coordination to mutually resolve the disagreement. Following mutual resolution, one of the following actions will be taken:
 - (1) If the resolution reflects that the ECP changes are required, the contractor shall submit a revised ECP incorporating the changes.
 - (2) If the resolution reflects that ECP changes different from those initially directed are required, MSFC will redirect the contractor. The contractor shall then submit a revised ECP.
 - (3) If the resolution reflects that the ECP changes initially directed are not required, MSFC will rescind its initial direction and redirect approval as written for the ECP.

NOTE: Submittal of a revised ECP shall be as directed by the procuring agency.

3.1.7.3 After Disapproval of ECP

The contractor shall not resubmit a disapproved ECP unless it has been revised to adequately address the reason for disapproval.

3.1.7.4 Releases Based on a Revised ECP

All contractor internal change control documentation (engineering drawings, specifications, modification instructions, etc.) released as the result of the ECP revision shall reference the revised ECP.

3.1.7.5 ECP Revision Documentation Requirements

3.1.7.5.1 ECP Revision Log

The contractor shall use an ECP revision log prepared in accordance with Appendix C to record all revisions to an ECP. The contractor shall submit a current log page with the first revision to an ECP and the log page shall be updated for each subsequent revision. The revision log shall be page three of each revised ECP.

3.1.7.5.2 Replacement Page Revisions

ECP replacement pages may be used to accomplish an ECP revision subject to the following requirements:

- a. Each replacement page shall be identified with ECP number, revision designation, and date placed in the top right corner.
- b. Page one of each ECP shall always be submitted as a replacement page. Page one shall show the ECP revision number and identify the replacement pages added.
- c. The replacement page(s) shall follow the format of the basic ECP with the revised information readily identified (e.g., vertical bar with revision designation in margin).
- d. The replacement page(s) shall be designated as either a superseding or additional page.
- e. The replacement page(s) shall be numbered to reflect the pages replaced. Where change information to any one page overflows to a second or more replacement pages, a decimal sequence number shall be added

sequentially to the replacement page number (e.g., 3.1, 3.2, 3.3, 3.n).

- f. When a revision must be incorporated on a previous replacement page, the new replacement page shall identify, by applicable revision symbol, only the revised information of the latest revision.

3.1.7.5.3 Superseding Revisions

If an ECP is revised extensively, the contractor may submit instead of replacement pages, an ECP which completely supersedes the previous submittal. For each ECP that is superseding, the following statement shall be the first entry in Block 8 of page 1: "This ECP supersedes ECP_____ Rev_____ in its entirety."

3.1.8 Additional Requirements for Facility Engineering Changes

In addition to the above stated ECP requirements, the following paragraphs apply to facility construction contracts.

3.1.8.1 Application

3.1.8.1.1 Initiation and Basis

Application of these requirements shall start at the beginning of the construction period and shall be based on the original construction drawings and specifications for each facility.

3.1.8.1.2 Periods

Facility engineering changes may occur during any of the following defined periods:

- a. The construction period - The period from start to completion of construction by the construction contractor or Government agency.
- b. Installation and Checkout (I&C) period - The period from construction completion or initial joint occupancy of the facility by the I&C contractor or agency and the construction contractor or agency until site turnover.
- c. Service period - The period of use starting at site turnover.

3.1.8.2 Responsibilities for Initiation of Class I Engineering

Changes3.1.8.2.1 Prior to Construction Completion

The construction contractor or Government agency shall be responsible for initiating ECP's for proposed Class I changes prior to change cutoff date or product configuration identification (PCI) status. PCI status occurs when MSFC declares that additional changes to the facility contracts can no longer be accepted for an operational site. The configuration of the facility when it reaches PCI status shall be defined by the construction specifications, construction drawings, and subcontractor drawings in force at that time, invoked on a site-by-site basis. This permits completion of construction and smooth transition into the Installation and Checkout (I&C) period.

3.1.8.2.2 Installation and Checkout Period

The I&C contractor or Government agency shall be responsible for initiating ECP's for all proposed Class I engineering changes after the facility has reached PCI status. The construction contractor or agency continues to have the responsibility for (1) providing information required to complete the ECP's prepared by the I&C contractor/agency, and (2) preparing ECP's for other facilities still under construction to which the change(s) may apply.

3.1.8.3 Format and Preparation Instructions

Format and preparation instructions for Class I facility engineering changes shall be in accordance with Appendix A to this exhibit with the following exceptions:

- a. The word "FACILITY" shall be placed below the words "ENGINEERING CHANGE PROPOSAL" on the ECP form.
- b. The following items on the noted lines shall be considered not applicable for a facility ECP:

Line 4: Delete "PART NO. OR TYPE DESIG."

Line 11: Delete entirely.
- c. The following additional clarifying instructions shall apply:

Line 2: Under "CEI NO.," insert the affected system or equipment designation.

Under "MFG. CODE," insert contractor's CAGE code, per Cataloging Handbook H4/H8.

Line 4: Under "CEI NOMENCLATURE," also insert the organizational designation; e.g., MSFC, Michoud Assembly Facility (MAF).

Under "PART OR LOWEST ASSY AFFECTED," enter the appropriate name of the facility subsystem.

Line 7: Under "DESCRIPTION OF CHANGE," the following additional information is required:

- (1) Any interface end-item which is dependent upon or responsible for the facility ECP shall be noted.
- (2) The facility location (e.g., MSFC, MAF) where the change can be made during construction.
- (3) The facility location where the change will require retroactive incorporation.
- (4) Complete schedules for change incorporation.

Line 8: Under "DATE BY WHICH CONTRACTUAL AUTHORITY IS NEEDED," the contractor shall specify whether architect engineering design is required and the date by which the complete design package is required.

3.2 Project Change Proposal

3.2.1 General

A PCP shall be used to propose changes to nontechnical requirements controlled by the MSFC Configuration Control Board (CCB), e.g., Type 1 Data Requirements. Prior to PCP submittal, the contractor shall obtain a PCN (see paragraph 3.3.4 of the basic portion of this document) for each PCP.

NOTE: When a change proposal is submitted by the contractor that impacts both technical and nontechnical data, the change to the nontechnical baseline documentation shall be identified in the ECP as an attachment. A separate PCP submittal is not required.

3.2.2 Instructions and Content

The contractor shall observe the following instructions and content requirements for submission of PCP's:

- a. Preparation instructions and a suggested format are provided in Appendix D to this exhibit.
- b. The contractor may use equivalent format, provided it contains the minimum information required by Appendix D and is approved by MSFC.
- c. When a contractually required and approved document is being changed, the PCP shall include a Document Change Notice (DCN). This DCN, subsequent Document

Change Instructions (DCI's), and replacement pages shall be prepared and processed in accordance with the specification maintenance requirements in Exhibit II, paragraph 3.4. The DCN and DCI formats along with completion instructions are contained in Appendix E to this exhibit.

3.2.3 Submittal

A PCP shall be processed by the contractor and submitted through the channels specified in the contract for Class I engineering changes. The number of copies for a PCP shall be as specified in the contract. PCP's shall be assigned a priority of routine, urgent, or emergency as defined in paragraph 3.3.5 of the general portion of this document. PCP's requiring expedited action shall be processed in a manner similar to expedited ECP's as stated in paragraph 3.1.5 of this exhibit.

3.2.4 Approval and Review

Receipt of contractual approval from MSFC shall constitute the sole authority for the contractor to implement a PCP.

3.3 Field Engineering Change Requirements

3.3.1 Purpose and Authority

An FEC is the expedited means for proposing emergency or urgent engineering changes at using sites on equipment for which MSFC retains design responsibility. An FEC shall be used when time is insufficient to process an ECP. Approval of an FEC by MSFC authorizes implementation of the change and may require a follow-up ECP. If the change action addressed by the FEC is applicable to subsequent effectivities, the contractor shall prepare an ECP to update the baseline design

requirements. If the change action addressed by the FEC is not applicable to subsequent effectivities, it is not mandatory that an ECP be submitted to revise the baseline design requirements. It is mandatory that a copy of the approved FEC be incorporated into the ADP. Prior to the FEC submittal, the contractor shall obtain a PCN (see paragraph 3.3.4 of the basic portion of this document) for each FEC.

3.3.2 Submittal and Processing Requirements

3.3.2.1 Number Assignment

The contractor shall assign a unique identification number to each FEC and shall maintain a log of all assigned FEC numbers.

3.3.2.2 Format and Instructions

FEC's shall be prepared and processed in accordance with the appropriate field site format and instructions. Format and processing instructions for specific sites may be obtained from the MSFC CM Office representative.

3.3.2.3 Tracking and Closeout Reporting

To provide the information needed to track FEC's and status accounting, the contractor shall use the mod kit Installation Notice Card (INC) to provide FEC installation and testing information. The INC instructions contained in Exhibit VII, paragraphs 4.2 through 4.2.3, shall be used (modified as necessary to reflect FEC installation) to provide FEC status information.

APPENDIX A

ENGINEERING CHANGE PROPOSAL

10.0 General

MSFC-Form 2348, Engineering Change Proposal, (Figures V-1 and V-1a) shall be prepared in accordance with these detailed instructions and the general requirements of paragraph 3.1 of this exhibit. An equivalent contractor form may be used if it contains all the data items shown in Figures V-1 and V-1a.

10.1 Preparation Instructions

<u>Block</u>	<u>Instructions</u>
1	NAME OF CONTRACTOR - Enter the name and address of contractor. PCN - Enter the MSFC-assigned number, reference paragraph 3.3.4 of the basic portion of this document. DATE - Enter the original or revised ECP submission date. PG 1 OF - Enter the total number of pages of the ECP.
2	CONTRACT NUMBER: - Enter the appropriate contract number. CAGE CODE: - See Exhibit IV, paragraph 3.2.7. SYSTEM DESIGNATION: - Enter the top level system or project identification. ECP NUMBER, SUF, and REV: - See paragraph 3.1.3 of this exhibit.
3	RECOMMENDED PRIORITY - Enter the proposed priority, as defined in paragraph 3.3.5 of the basic portion of this document.
4	CEI NUMBER AND NOMENCLATURE - PART OR LOWEST ASSEMBLY AFFECTED - Enter the CEI identification, part number, and the most complete descriptive name of the part(s) or lowest assembly(ies) affected by the change.

- 5 TITLE OF CHANGE - Enter a brief but descriptive title indicating the purpose and/or subject of the change.
- 6 JUSTIFICATION FOR CHANGE: - Enter a comprehensive definition of the problem which the change proposes to correct or the new capability which the change proposes to provide. Describe in detail the nature of the problem which substantiates the need for the change, including consequences if the change is not incorporated. The contractor shall make full use of applicable failure data and reference any nonconformance report(s) that provide(s) exact details applicable to the change. When the change is directed toward providing a new capability, describe the capability in quantitative terms (e.g., improvement in payload weight, mission parameters, performance, or data gathering accuracy). Summarize any correspondence or previous coordination leading to the submission of this change. Include a summary of any studies or testing accomplished prior to the submission of the ECP. Check whether this ECP is a contractor-requested change or a response to a procuring activity direction.
- 7 ENVIRONMENTAL IMPACT: - Identify and define any potential environmental impact that may result from the approval or disapproval of this proposed change.
- 8 DESCRIPTION OF CHANGE: - Check the appropriate block if alternate solution(s) are included. Include ECP supersession data (see 3.1.7.5 of this exhibit). Provide sufficient detail on the change to permit ready identification and evaluation. Include in the description which part(s) of the system or facility item is/are being changed and the type of change being made. Use supplemental drawings, sketches, and analyses to the extent necessary to clearly define the proposed change. Identify if the problem can be resolved by revised operation or maintenance procedures, revised schedules, etc. State the advantages and disadvantages inherent in feasible alternative approaches to the problem. Include any alternative solutions that may be available based on prechange analysis.

- 9 DATE BY WHICH CONTRACTUAL AUTHORITY IS NEEDED: -
Enter the date that authority to proceed is
required to maintain the effectivities and
change periods proposed in Line 10.
- 10 EFFECTIVITY AND MANDATORY CHANGE PERIODS FOR
INCORPORATION:
- VEHICLE/SITE & ITEM SERIAL NO. - List the
applicable site, system, and CEI designation(s)
and/or serial number(s) affected by the change.
- CHANGE PERIOD - Enter a change period
designation for each proposed effectivity. MSFC
will provide these designations to the
contractor as soon as they are established for
the specific MSFC programs.
- MOD. KIT DELIVERY DATE - If appropriate, enter
the date based on the proposed contractual
coverage date and change periods.
- EST M/H FOR MOD. KIT INSTL. - Enter the
estimated man-hours per unit required to install
the change in the item.
- OUT-OF-SERVICE TIME - Enter the estimated unit
out-of-service time or inoperative time that
will be required to incorporate the change.
- 11 MODIFICATION, RETEST, REQUALIFICATION
- YES or NO Blocks - Check the appropriate blocks
and identify the enclosure and paragraph for any
detailed explanation submitted with the ECP.
- 12 PAGE TWO HEADING
- Re-enter appropriate data from page 1, Lines 1
and 2.
- 13 GENERAL ITEMS AND ACTIVITIES - Indicate the
effect of the change by checking the appropriate
YES or NO box. Enter the enclosure and
paragraph identification of data which fully
explains the advantages and disadvantages of the
proposed change. Use quantitative values
whenever practicable. Additional requirements
applicable to specific blocks are included in
the following subsections.

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Development requirements and status - This block also includes any effect on items of flight or ground support equipment to be used in conjunction with the change, with a description of their relationship, availability, and impact.

Safety - Provide a definitive description of any system safety impact(s) or have available the analysis which supports no impact. As a minimum, the following areas must be considered:

- a. The elimination or introduction of and impact to single failure points that could result in loss of life or mission;
- b. Any variation in established safety factors or margins;
- c. Material changes that would either increase or decrease potential hazards or affect compatibility;
- d. Changes that would affect the flammability of material, leakages, or explosions;
- e. Changes that affect limited life, cycle, or age items that are related to potential hazards; and
- f. Changes in redlines and other launch and flight constraints.

Reliability - Submit a preliminary Reliability Data Summary (RDS) with each applicable ECP submitted for approval. An RDS is required only on flight hardware and/or mission events sequence change-oriented ECP's. A suggested format for the RDS is depicted in Figure V-2. A contractor format is acceptable provided that the information from Figure V-2 is included as a minimum.

Engineering Critical Components (Items)- If components (items) have been qualified, identify what impact the change will have on qualification, including requalification or changes to qualification requirements.

- 14 LOGISTICS - Check the applicable boxes for logistic support areas that will be affected. Identify enclosures that provide the appropriate

detailed explanations. Include the following general logistics information, as applicable:

- a. Identification and description of the specific support materials affected;
 - b. Identification, description, recommended quantity, and anticipated delivery schedule of any new logistic support material;
 - c. Effectivity for incorporation of the change in logistic support material and the estimated delivery schedule;
 - d. Identification and description of logistic support material modification kits and recommended quantity, rework instructions, tools, and equipment required; and
 - e. A summary of the estimated man-hours for complete and total logistic support conversion.
- 15 INTERFACE - Identify, by numbers, the IRD's/ICD's and associated PIRN's affected by the proposed change. Also include the names, dates, and results of interface coordination with associated contractors or MSFC. Include identifying numbers, if available, of the associated contractor's ECP's.
- 16 CONTRACT SPECIFICATION(S)/DRAWINGS - Identify the number of any contract specification or directly referenced drawing affected by the proposed change. Check blocks as applicable and provide description of impact, identifying the enclosure and paragraph where found. Also identify each SCN attached to the ECP and associated specifications.
- 17 EST. TOTAL PROGRAM COSTS & DETAILED BREAKDOWN ARE PROVIDED IN ENCLOSURE - Identify enclosure(s) which provide the estimated total change in program costs, including a breakdown by the following cost elements; as applicable:
- a. Development requirements;
 - b. Changes in production, including logistic support;
 - c. Mod kits, including logistic support material, GFP and GFE;

- d. Special tools;
- e. New logistic support material;
- f. Retest required for requalification;
- g. Factory direct costs; and
- h. Other cost elements affected by the ECP.

18 SUMMARY OF EFFECT OF PROPOSED AND PREVIOUSLY APPROVED CHANGES ON MAJOR CEI - Identify enclosure(s) that summarize(s) the cumulative effect upon performance, payload capability, electrical load, etc., caused by previously approved ECP's when design limitations are being approached or exceeded.

10.2 Continuation Sheets, Enclosures, or Attachments

Any required continuation sheets, enclosures, or attachments shall be identified as specified in paragraph 10.1, Line 12.

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1	NAME OF CONTRACTOR:		ENGINEERING CHANGE PROPOSAL (ECP)		PCN:		DATE: Page 1 of			
2	CONTRACT NO.:	CAGE	SYSTEM DESIGNATION:		ECP NO.:		SUFFIX:	REV:		
3	RECOMMENDED PRIORITY: <input type="checkbox"/> Emergency <input type="checkbox"/> Urgent <input type="checkbox"/> Routine									
4	CEI NUMBER AND NOMENCLATURE:				PART OR LOWEST ASSEMBLY AFFECTED					
					PART NO.:		NAME:			
5	TITLE OF CHANGE:									
6	JUSTIFICATION FOR CHANGE (Include consequences if not incorporated):									
	<input type="checkbox"/> REQUESTED <input type="checkbox"/> DIRECTED BY PROCURING ACTIVITY PER REF.:									
7	ENVIRONMENTAL IMPACT: <input type="checkbox"/> YES <input type="checkbox"/> NO If YES, identify the enclosure containing the Environmental Impact Statement.									
8	DESCRIPTION OF CHANGE (Alternate solutions included <input type="checkbox"/> YES <input type="checkbox"/> NO):									
9	DATE BY WHICH CONTRACTUAL AUTHORITY IS NEEDED:									
10	EFFECTIVITY AND MANDATORY CHANGE PERIOD(S) FOR INCORPORATION									
	Vehicle/Site and Item Serial No.		Change Period		Mod Kit Delivery Date		Est. M/H for Mod Kit Instl.		Out-of-Service Time	
		EFFECT ON:		ITEM		Encl.		Para.		
11	Yes		No							
	<input type="checkbox"/>		<input type="checkbox"/> Previously issued modification instructions affected (Explain)							
	<input type="checkbox"/>		<input type="checkbox"/> Proofing of modification instructions and kit installation required							
	<input type="checkbox"/>		<input type="checkbox"/> Proofing Location: _____							
	<input type="checkbox"/>		<input type="checkbox"/> Retest required (Identify test invalidated by change)							
<input type="checkbox"/>		<input type="checkbox"/> Requalification required (Include description of test plan for requalification)								

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Figure V-1. MSFC-Form 2348, Engineering Change Proposal, Page 1

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12	NAME OF CONTRACTOR:	ECP NO.:	PCN:	Page 2 of _____
13	<p>EFFECT ON:</p> <p>Yes No</p> <p><input type="checkbox"/> <input type="checkbox"/> Development Requirements and Status</p> <p><input type="checkbox"/> <input type="checkbox"/> Safety</p> <p><input type="checkbox"/> <input type="checkbox"/> Reliability (Include reliability data summary)</p> <p><input type="checkbox"/> <input type="checkbox"/> Service Life</p> <p><input type="checkbox"/> <input type="checkbox"/> Test and Checkout Requirements</p> <p><input type="checkbox"/> <input type="checkbox"/> Test/Operating Procedures</p> <p><input type="checkbox"/> <input type="checkbox"/> Process Specifications</p> <p><input type="checkbox"/> <input type="checkbox"/> Radio Frequency or Electromagnetic Interference</p> <p><input type="checkbox"/> <input type="checkbox"/> Computer Programs (For use at Using Site)</p> <p><input type="checkbox"/> <input type="checkbox"/> Engineering-Critical Components (Items)</p> <p><input type="checkbox"/> <input type="checkbox"/> Other ECP's Affected by this Change</p>	ITEM	ENCL.	PARA.
14	<p><input type="checkbox"/> <input type="checkbox"/> Logistics</p> <p><input type="checkbox"/> <input type="checkbox"/> Spares (Include Spares Modification Plan)</p> <p><input type="checkbox"/> <input type="checkbox"/> GFE/GFP/Trainers</p> <p><input type="checkbox"/> <input type="checkbox"/> Data/Publications</p> <p><input type="checkbox"/> <input type="checkbox"/> Age and Cycle-Critical Components (Items)</p>			
15	<p><input type="checkbox"/> <input type="checkbox"/> Interface</p> <p><input type="checkbox"/> <input type="checkbox"/> PIRN's Attached</p> <p>IRI/ICD No.: _____ PIRN No.: _____</p> <p>IRI/ICD No.: _____ PIRN No.: _____</p> <p>IRI/ICD No.: _____ PIRN No.: _____</p> <p><input type="checkbox"/> <input type="checkbox"/> ECP/PIRN coordinated with associate contractor(s) or MSFC. Provide name(s)/dates of initiation and results of coordination.</p>			
16	<p><input type="checkbox"/> <input type="checkbox"/> Contract Specification(s)/Drawings</p> <p>Spec. No.: _____ Dwg. No.: _____</p> <p>Spec. No.: _____ Dwg. No.: _____</p> <p><input type="checkbox"/> <input type="checkbox"/> Text of Specifications Affected</p> <p><input type="checkbox"/> <input type="checkbox"/> Contract and Specification Requirements</p> <p><input type="checkbox"/> <input type="checkbox"/> Performance</p> <p><input type="checkbox"/> <input type="checkbox"/> Payload Capability</p> <p><input type="checkbox"/> <input type="checkbox"/> Delivery Schedule (Undelivered Items)</p> <p><input type="checkbox"/> <input type="checkbox"/> Other:</p> <p><input type="checkbox"/> <input type="checkbox"/> Specification Change Notices Attached:</p> <p>Spec. No.: _____ SCN No.: _____</p> <p>Spec. No.: _____ SCN No.: _____</p>			
17	Estimated Total Program Costs and Detailed Breakdown are Provided in Enclure			
18	Summary of Effect of Proposed and Previously Approved Changes on Major CEI			

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Figure V-1a. MSFC-Form 2348, Engineering Change Proposal, Page 2

RELIABILITY DATA SUMMARY	
A.	<u>ECP TITLE:</u>
B.	<u>ECP NUMBER:</u>
C.	<u>BRIEF DESCRIPTION OF THE PROPOSED CHANGE:</u>
D.	<u>DOES THIS CHANGE AFFECT THE FMEA AND CRITICALITY DETERMINATION DATA FOR THE CEI? IF SO, BRIEFLY DESCRIBE:</u>
E.	<u>IF THERE IS NO CHANGE, BRIEFLY DESCRIBE WHY:</u>

Figure V-2. Reliability Data Summary Format

APPENDIX B

RECORD ENGINEERING CHANGE PROPOSAL

20.0 General

The Record ECP (RECP) as shown in Figure V-3 (or equivalent) shall be prepared in accordance with these detailed instructions and the general requirements of paragraph 3.1.1.4 of this exhibit.

20.1 Preparation Instructions

<u>Block</u>	<u>Instructions</u>
1	SUBMITTING CONTRACTOR - Enter the identification of contractor submitting the RECP.
2	RECORD ECP NO. - Enter the record ECP number assigned by the submitting contractor.
3	PCN - Enter the MSFC assigned PCN (see paragraph 3.3.4 of the basic portion of this document).
4	DATE- Enter the date the RECP is submitted.
5	INITIATOR (Company name or Gov't Agency) - Enter the identification of the initiator of the change.
6	INITIATOR'S CHANGE NUMBER - Enter the number, if available, of the initiator's change action.
7	MSFC LETTER NO. - Enter the number of the MSFC letter which forwarded the change (if applicable).
8	PIRN/IRN/SCN/DCN NO. - Enter the number(s) of the appropriate PIRN(s)/IRN(s)/SCN(s)/DCN(s).
9	DOCUMENT NO. - Enter the number(s) of the document(s) affected by the PIRN(s)/IRN(s)/SCN(s)/DCN(s).
10	REV. - Enter the revision letter of the affected document(s).
11	TITLE - Enter the title(s) of the affected document(s).
12	EFFECTIVITY - Enter the hardware and/or software effectivity(ies) of the change(s).

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- 13 NAME - Enter the name of the contractor contact responsible for submittal of this RECP.
- 14 ORGANIZATION - Enter the contractor organization responsible for submittal of this RECP.
- 15 EXTENSION - Enter the phone extension/number of the contractor contact responsible for submittal of this RECP.
- 16 STATEMENT OF ACCEPTANCE - Enter the name of other contractor(s) considered to be affected by this change. Use an attachment if required. Include any pertinent remarks concerning this change on the attachment.
- 17 CONTRACTOR SIGNATURE - To be signed by the responsible contractor official.
- 18 DATE - Enter the date the RECP was approved and signed.

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RECORD ECP				
1. SUBMITTING CONTRACTOR:		2. RECORD ECP NUMBER:		3. PCN:
4. DATE:				
THIS SUBMITTAL CONSTITUTES A RESPONSE TO:				
5. INITIATOR (COMPANY NAME OR GOVERNMENT AGENCY):			6. CHANGE NO.:	7. MSFC LETTER NO.:
CHANGE IDENTIFICATION				
8. PIRN/IRN/SCN/DCN NO.	9. DOCUMENT NO.	10. REVISION	11. DOCUMENT TITLE	12. EFFECTIVITY
FOR FURTHER INFORMATION CONCERNING THIS SUBMITTAL CONTACT:				
13. NAME:		14. ORGANIZATION:		15. EXTENSION:
16. The above change(s) is/are acceptable as a documentation change(s) and <input type="checkbox"/> does <input type="checkbox"/> does not affect cost, schedule, hardware, and/or software. The above change(s) also affect(s) the following contractor(s):				
17. CONTRACTOR SIGNATURE:				18. DATE:

MSFC Form 4242 (August 1994)

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Figure V-3. MSFC Form 4242, Record ECP

APPENDIX C

ENGINEERING CHANGE PROPOSAL REVISION LOG

30.0 General

The ECP Revision Log (Figure V-4) shall be prepared in accordance with these detailed instructions and the general requirements of paragraph 3.1.7.5.1 of this exhibit. An equivalent contractor format may be used if the format contains all data items shown.

30.1 Preparation Instructions

Instructions are keyed to block numbers on the sample form, Figure V-4.

<u>Block</u>	<u>Instruction</u>
1	BASIC ECP NO. - Enter the basic number of ECP being revised.
2	AS OF - Enter the date of preparation or updating of revision log.
3	PAGE - Enter appropriate page designation of the log page.
4	REV. NO. - Enter appropriate ECP revision designation.
5	DATE - Enter date of ECP revision.
6	PAGES AFFECTED - Enter ECP pages affected by each revision. Enter "X" in the appropriate column to indicate that affected pages are superseded, added, or deleted.
7	REMARKS - Enter any additional data necessary to explain or clarify the revision action.

<p>(CONTRACTOR'S NAME)</p> <p>ECP REVISION LOG</p> <div style="display: flex; justify-content: space-between; align-items: flex-end;"> <div style="text-align: right;"> <p>AS OF _____ (2)</p> <p>PAGE _____ (3)</p> </div> <div style="text-align: left;"> <p>BASIC ECP NO. _____ (1)</p> </div> </div>						
REV. NO.	DATE	PAGES AFFECTED		A	D	REMARKS

S = SUPERSEDED A = ADDED D = DELETED

Figure V-4. ECP Revision Log Format

APPENDIX D

PROJECT CHANGE PROPOSAL

40.0 General

Figure V-5, MSFC-Form 4240, Project Change Proposal, shall be prepared in accordance with the detailed instructions and the general requirements of paragraph 3.2 of this exhibit. Any continuation sheets must contain proper change proposal identification as indicated on Figure V-5a. An equivalent contractor format may be used if the format contains all data items shown.

40.1 Preparation Instructions

The following instructions are keyed to the block numbers on the sample format. If a contractor format is used, data provided must meet the intent of these instructions.

<u>Block</u>	<u>Instruction</u>
1	CONTRACTOR IDENTIFICATION - Enter the contractor identification.
2	DATE - Enter the PCP submittal date.
3	Page 1 of - Enter the total number of pages.
4	PCP NO. - Enter the contractor's PCP number.
5	Rev. - Enter the revision level of PCP.
6	CONTRACT NO. - Enter the contract number or other identification.
7	CAGE CODE - Enter the contractor's CAGE Code per Cataloging Handbook H4/H8.
8	PCN - Enter the assigned PCN; reference paragraph 3.3.4 of basic manual.
9	ITEM/REQUIREMENT AFFECTED - Enter the description of contractual requirements affected.
10	EFFECTIVITY/SCOPE - Enter programmatic/item effectivity or the scope of requirements affected, if applicable.

- 11 TITLE OF CHANGE - Enter a brief descriptive title of the change.
- 12 NEED FOR CHANGE - Enter a comprehensive definition of the problem or deficiency that the PCP proposes to correct or provide other justification for the change. Explain benefit(s) of making change and impact of not making the change.
- 13 DESCRIPTION OF CHANGE - Enter a detailed description of the proposed change with sufficient information to permit identification and evaluation. Where appropriate, include definitive requirements language that can be used in contractual authority documents.
- 14 DATE CONTRACTUAL AUTHORITY NEEDED - Enter the date by which contractual authority to proceed is required for contractor to meet objectives of the change.
- 15 PRIORITY - Enter the proposed priority as defined in paragraph 3.3.5 of the general section of this document.
- 16 COST ESTIMATES - Provide an estimate of resource impact including GFP requirements, manpower, cost, etc. Manpower and cost estimates should be in sufficient detail to permit analysis and allocation of cost elements.
- 17 ENCLOSURES - Enter the identification of all enclosures.

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Exhibit V - Appendix D

1. CONTRACTOR IDENTIFICATION:	PROJECT CHANGE PROPOSAL (PCP)	2. DATE:	3. Page of
		4. PCP NO.:	5. REV.:
6. CONTRACT NO.:	7. CAGE CODE:	8. PCN:	
9. ITEM/REQUIREMENT AFFECTED:		10. EFFECTIVITY/SCOPE:	
11. TITLE OF CHANGE:			
12. NEED FOR CHANGE:			
13. DESCRIPTION OF CHANGE:			
14. DATE CONTRACTUAL AUTHORITY NEEDED:		15. PRIORITY:	
16. COST ESTIMATE:			
17. ENCLOSURES:			

MSFC Form 4240 (August 1994)
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Figure V-5. MSFC-Form 4240, Project Change Proposal

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1. CONTRACTOR IDENTIFICATION:	PROJECT CHANGE PROPOSAL (PCP) Continuation Page	2. DATE:	3. Page of
		4. PCP NO.:	5. REV.:
6. CONTRACT NO.:	7. CAGE CODE:	8. PCN:	
INDICATE ITEM OR BLOCK NUMBER CONTINUATION:			

MSFC Form 4240-1 (August 1994)

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Figure V-5a. MSFC-Form 4240-1, Project Change Proposal
Continuation Sheet

APPENDIX E

DOCUMENT CHANGE NOTICE AND DOCUMENT CHANGE INSTRUCTIONS

50.0 General

The DCN (Figure V-6) and DCI (Figure V-7) shall be prepared in accordance with the detailed instructions and the general requirements of paragraph 3.2.2 of this exhibit. An equivalent contractor format may be used if the format contains all the data items shown.

50.1 Document Change Notice Preparation Instructions

The DCN shall be prepared using the form shown in Figure V-6 or equivalent. The required information is described as follows:

<u>Block</u>	<u>Instructions</u>
1	CONTRACTOR NAME AND CAGE CODE - Self-explanatory.
2	DOCUMENT - Enter the identification number of the document affected.
3	REV - Enter the revision version of the document affected.
4	DCN NO - Enter the DCN sequence number determined by the specification custodian.
5	PAGE NO. AND DATE - Self-explanatory.
6	PROGRAM/PROJECT NAME - Self-explanatory.
7	DOCUMENT NOMENCLATURE - Enter the title, subject, or other unique description of the document.
8	ECP/PCP NUMBER, PCN, CONTRACT NUMBER - Self-explanatory.
9	CONTRACT AUTHORITY - Will be entered by MSFC.
10	EFFECTIVITY - CEI or other effectivity of this change.
11	DESCRIPTION OF CHANGE - Provide definitive description of the change to the document.

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DOCUMENT CHANGE NOTICE

CONTRACTOR NAME: ①		CAGE CODE ①	DOCUMENT NO. ②	REV.	PAGE NO. 1 OF ____ ⑤
			DCN NO. ④		DATE: ⑤
PROGRAM/PROJECT NAME: ⑥		DOCUMENT NOMENCLATURE: ⑦			
ECP/PCP NUMBER: ⑧	PCN ⑧	CONTRACT NUMBER ⑧		CONTRACT AUTHORITY: ⑨	
EFFECTIVITY: ⑩					
DESCRIPTION OF CHANGE: ⑪					

Figure V-6. Document Change Notice Format

50.2 Document Change Instruction Preparation Change
Instructions

The DCI shall be prepared using the suggested format shown in Figure V-7. The following data elements shall be included in the DCI:

- a. Document number.
- b. DCI release date.
- c. Change identification including ECP/PCP number, date, and PCN. *
- d. DCN number. *
- e. Contract modification number and date. *
- f. Replacement page instructions: Enter the page number(s) of the page(s) to be replaced, deleted, or added, or enter the new revision level. *

* NOTE: Items c. through f. are cumulative to show the complete history of the document changes and revision.

An equivalent contractor format may be used if it contains all the data items shown.

DOCUMENT CHANGE INSTRUCTION				
DOCUMENT NO.:			DATE OF RELEASE:	
			PAGE ____ OF ____	
DCN No.	ECP/PCP No./ DATE	PCN	CONTRACT MOD/ DATE	REPLACEMENT PAGE INSTRUCTIONS

Figure V-7. Document Change Instruction Format

EXHIBIT VI
DEVIATIONS AND WAIVERSTABLE OF CONTENTS

<u>Paragraph</u>		<u>Page</u>
	LIST OF FIGURES	VI-i
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2.0	SCOPE	VI-1
3.0	REQUIREMENTS	VI-1
3.1	Deviation and Waiver Criteria	VI-1
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EXHIBIT VI

DEVIATIONS AND WAIVERS

1.0 PURPOSE

This exhibit provides uniform practices for submitting Deviation/Waiver Approval Requests (DAR's).

2.0 SCOPE

This exhibit defines responsibilities and procedures for preparing and processing DAR's involving contracts, purchase orders, and basic ordering agreements.

3.0 REQUIREMENTS3.1 Deviation and Waiver Criteria

- a. When a departure from a specification, drawing, or related documents which impacts Class I change criteria is known or planned before the production of an item, the contractor shall submit a DAR as a deviation to identify and obtain authorization for the departure. Deviations shall be used to obtain approval of departures when the "as-required" or "as-designed" definition is correct, but a temporary departure from baseline requirements is necessitated.
- b. When a departure from a specification, drawing, or related documents which impact Class I change criteria is identified during or after production of an item, and the item is considered suitable for use "as-is" or usable after repair by an approved method (other than previously approved standard repairs), the contractor shall submit a DAR as a waiver to obtain MSFC authorization for use of the item. Nonconformances which do not meet Class I change criteria as defined in Section 3.0 of the basic document shall be processed in accordance with the contractor's internal material review procedures (Material Review Board or equivalent).
- c. Deviations or waivers shall not be used as a means of correcting design errors or for permanent changes to technical requirements. Permanent engineering changes require submission of an ECP.

3.2 Provisions

- a. A DAR may apply to multiple units of a specific part number; however, the nonconforming condition(s) must be fully applicable, without exception, to all affected parts as follows:

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- (1) For serial numbered parts, the serial number(s) affected shall be specified.
 - (2) For lot numbered parts, the lot number(s) affected shall be specified and the DAR shall be applicable to all parts in the affected lots. Lots shall be redesignated, if necessary, to segregate units affected. Tabulating unique waiver conditions applicable to only some of the units within a lot is prohibited.
 - (3) For parts neither serial numbered nor lot numbered, the DAR shall specify the next higher assembly(ies) (by part number and serial number or other equally definitive means) into which the parts affected by the DAR are installed. The DAR shall apply to all parts installed in each identified using assembly or shall specifically identify the location of the affected parts in each using assembly.
 - (4) When a DAR is written against a requirement in a CEI document, individual part numbers affected may be identified, when appropriate.
- b. DAR's shall be submitted for a specified number of items and/or a specific period of time. Usage limitations, when justified, shall be specified in accordance with paragraph 4.1, Block 18.
- c. DAR revisions shall supersede previous issues in their entirety. Revisions shall be processed as new DAR's. Pen and ink changes may be made only for editorial corrections and shall be initialed by the appropriate MSFC CCB chairperson.
- d. All approved DAR's and nonconformances must be listed on the Government shipping document (DD Form 250 or equivalent) for the applicable CEI.
- e. A contractor may request expedited DAR approval from the contracting officer pending formal processing of MSFC Form 847. The following conditions apply:
- (1) Contractor records shall reflect the date, time, and manner in which the expedited DAR was approved and the name of the person making the approval.
 - (2) A formal DAR shall subsequently be submitted for approval, and a copy incorporated into the acceptance data package following disposition.

4.0 FORMS AND PREPARATION INSTRUCTIONS

MSFC contractors shall use the MSFC Forms 847 series or equivalent.

4.1 Preparation Instructions for MSFC FORM 847

The following instructions refer to the numbered blocks on MSFC Form 847, Deviation/Waiver Approval Request (DAR), Figure VI-1 . If additional space is required for any block number, it should be typed on MSFC Form 847-1, DAR continuation sheet, (see paragraph 4.2). The number of the block, continued from sheet 1, shall also be referenced.

<u>Block</u>	<u>Instructions</u>
1	INITIATING ORGANIZATION - Enter the name and address of the contractor submitting the DAR.
2	PCN - Enter the PCN as assigned by the MSFC project CM office.
3	DATE - Enter date form is submitted.
4	PAGE 1 OF - Enter the total number of pages of MSFC Form 847 and related continuation sheets, MSFC Form 847-1.
5	DAR NO - Enter the DAR number as assigned by the originating organization.
6	REV - Leave blank for an original DAR issuance. Revisions shall be identified by R-1, R-2, etc. When a revision entry is made in this block, the following statement shall be entered in Block 21: "This revision supersedes DAR _____ in its entirety.
7 & 8	DEVIATION - WAIVER - Enter check in Block 7 or 8 based on the definitions of a deviation and a waiver in Paragraph 3.1.
9	CONTRACT NO - Enter the contract number that governs the procurement of the CEI or project affected.
10	PN/DOC NO - Enter part, assembly, or document number.

- 11 PN/DOC DESCRIPTION - Enter description of the CEI, document, affected part, or project identified by the entry in Block 10.
- 12 DAR TITLE - Enter a title that is descriptive of the nonconformance.
- 13 REJECTION - Enter the document number of the document used to reject the item.
- 14 SERIAL NUMBER(S) - Enter the serial number(s) of the item(s), if applicable.
- 15 LOT NO - Enter the lot number of the item(s), if applicable.
- 16 QUANTITY - Enter the quantity of items in the DAR.
- 17 SUPPLIER OR SUBCONTRACTOR NAME AND ADDRESS - Enter the item supplier or subcontractor, if applicable.
- 18 EFFECTIVITY: - Enter the following, as applicable:

- (1) Effectivity
- (2) Mission Identification
- (3) Contract End Item/Top Assembly number
- (4) Next Higher Assembly number(s)

These designations shall denote the effectivity(ies), specific missions, CEI's/TA's, or NHA's for which usage of items with the waived condition is acceptable.

- 19 SPECIFIED REQUIREMENTS - State the requirements, as specified in drawings, specifications, or other baseline data which are to be violated or require exception.
- 20 JUSTIFICATION FOR DAR - Enter the supporting rationale for the DAR. Include the safety impact statement that identifies the hazard documentation affected, reflects any associated risk, and indicates if baseline hazard/critical items list (CIL) documentation update is necessary.
- 20a ENVIRONMENTAL IMPACT - Check either the "Yes" or "No" block indicating whether acceptance or

disapproval of the deviation or waiver will result in an environmental impact. If so, provide details on continuation page(s).

- 21 DESCRIPTION OF DEPARTURE FROM REQUIREMENTS - Describe the requested departure from the specified requirements. Describe the nonconformance as completely as possible showing the extent of the departure. Attach sketches if required for clarification. The actual difference between the specified requirements and the variation shall be readily discernible.
- 22 CORRECTIVE ACTION TAKEN - Check either the "Yes" or "No" block indicating whether corrective action has been taken.
- 23 ICD AFFECTED - Check either the "Yes" or "No" block as to whether an ICD is affected by this DAR.
- 24 FMEA/CIL AFFECTED - Check either the "Yes" or "No" block as to whether the failure mode and effects analysis/critical items list (FMEA/CIL) is affected by this DAR.
- 25 CONTRACTOR CERTIFICATION - The contractor shall complete this block with the title, signature, and date signed. Check either "Yes" or "No" in the cost adjustment section.
- 26 RESIDENT GOVERNMENT S&MA REPRESENTATIVE COMMENTS - This block will be completed by the designated Government representative for the contractor's facility.
- 27 MSFC CCBD NO - This block will be completed by the MSFC CCB secretariat.
- 28 MSFC APPROVAL AUTHORITY - This block will be completed by the MSFC contracting officer.

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1. INITIATING ORGANIZATION:		DEVIATION/WAIVER APPROVAL REQUEST (DAR)		2. PCN:	3. DATE:
5. DAR NUMBER:		6. REVISION:	7. DEVIATION <input type="checkbox"/>	9. CONTRACT NO.:	
10. PN/DOCUMENT NO.:		11. PN/DOCUMENT DESCRIPTION:			
12. DAR TITLE:					
13. REJECTION DOCUMENT NO.:	14. SERIAL NUMBER(S):	15. LOT NUMBER:		16. QUANTITY:	
17. SUPPLIER OR SUBCONTRACTOR NAME AND ADDRESS:			18. EFFECTIVITY:		
19. SPECIFIED REQUIREMENTS:			20. JUSTIFICATION FOR DAR:		
			20a. ENVIRONMENTAL IMPACT <input type="checkbox"/> YES (If yes, explain on Continuation) <input type="checkbox"/> NO		
21. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:					
22. CORRECTIVE ACTION TAKEN <input type="checkbox"/> YES (If yes, explain on Continuation) <input type="checkbox"/> NO		23. ICD AFFECTED <input type="checkbox"/> YES (If yes, explain on Continuation) <input type="checkbox"/> NO		24. FMEA/CIL AFFECTED <input type="checkbox"/> YES (If yes, explain on Continuation) <input type="checkbox"/> NO	
25. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DAR IS A DEPARTURE FROM CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE. COST ADJUSTMENT <input type="checkbox"/> YES <input type="checkbox"/> NO (If yes, explain on Form 847-1)					
_____ TITLE		_____ SIGNATURE OF AUTHORIZED REP		_____ DATE	
26. RESIDENT GOVERNMENT S&MA REPRESENTATIVE COMMENTS:					
27. MSFC CCBd NO.: <input type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED <input type="checkbox"/> APPROVED SUBJECT TO CONDITIONS PER ATTACHED CCBd		28. MSFC APPROVAL AUTHORITY <input type="checkbox"/> APPROVED <input type="checkbox"/> DISAPPROVED <input type="checkbox"/> APPROVED SUBJECT TO CONDITIONS STATED ON MSFC FORM 847-2) _____ SIGNATURE DATE ORGANIZATION CODE			

MSFC Form 847 (Rev. August 1994)

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Figure VI-1. MSFC Form 847, Deviation/Waiver Approval Request (DAR)

4.2 Preparation Instructions For MSFC Form 847-1

The following instructions refer to the numbered blocks on MSFC Form 847-1, DAR Continuation Sheet, shown in Figure VI-1a:

<u>Block</u>	<u>Instructions</u>
1	DAR NO. - Enter the DAR number entered in Block 5 of MSFC Form 847 to which this form is attached.
2	REV. - Enter the REV letter assigned in Block 6 of MSFC Form 847 to which this form is attached.
3	PCN - Enter the PCN in Block 2 of MSFC Form 847 to which this form is attached, if applicable.
4	DATE - Enter the date in Block 3 of MSFC Form 847 or Block 4 of MSFC Form 847-1, as applicable.
5	Page 2 of - Enter the page number of each continuation page and the total number of pages included in the DAR forms set (MSFC Form 847 and continuation sheets).
6	FORM NUMBER/BLOCK NUMBER/TEXT - Enter the DAR form number, block number, and text to be continued from MSFC Form 847.

4.3 Information on MSFC Form 847-2

MSFC Form 847-2, DAR Subject to Conditions, shown for information in Figure VI-2, will be completed by the MSFC CCB secretariat and returned to the contractor with the dispositioned DAR if the CCB approval reflects any conditions, restrictions, or modifications to the original DAR.

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1. DAR NUMBER:	DEVIATION/WAIVER APPROVAL REQUEST (DAR) (CONTINUATION PAGE)	3. PCN:	4. DATE
2. REVISION			5. PAGE of
6. INDICATE ITEM OR BLOCK NUMBER OF CONTINUATION:			

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Figure VI-1a. MSFC Form 847-1, DAR Continuation Sheet

1. DAR NUMBER:	DEVIATION/WAIVER APPROVAL REQUEST (DAR) <u>SUBJECT TO CONDITION(S)</u>	3. PCN:	4. DATE:
2. REVISION:			5. PAGE of
6. CONDITION(S) (USE MSFC FORM 847-1 FOR CONTINUATION):			
7. IMPLEMENTATION OF THIS DAR <input type="checkbox"/> SHALL PROCEED <input type="checkbox"/> SHALL NOT			

MSFC Form 847-2 (Rev. August 1994)

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Figure VI-2. MSFC Form 847-2, DAR Subject to Condition(s)

EXHIBIT VII
MODIFICATION KITS AND INSTRUCTIONSTABLE OF CONTENTS

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EXHIBIT VII

MODIFICATION KITS AND INSTRUCTIONS

1.0 PURPOSE

This exhibit identifies requirements for installation of Class I approved engineering changes into CEI's following acceptance.

2.0 SCOPE

This exhibit specifies the requirements and instructions to be provided to the using site for accomplishing retrofit/modifications to any flight elements, systems, and related equipment, facility support systems, and associated support equipment.

3.0 REQUIREMENTS

3.1 Mod Kit Usage and Contents

Modification of a CEI at a using site shall be accomplished only by a Mod Kit, except for FEC's originated and processed at a using site. Mod Kits and Instructions include hardware and/or software for the CEI and the associated change documentation.

3.2 Source of Requirements for Mod Kits

The requirement for a Mod Kit shall be identified by the contractor or by a using site when retrofit is required to a hardware or software CEI that has been accepted by MSFC.

3.3 Mod Kit Approval

Whether the requirement for a Mod Kit is initiated by the contractor or a using site, the documentation identifying the proposed change shall be submitted by the contractor via an ECP for approval.

3.4 Mod Kit Identification

The identification number of the Mod Kit shall be assigned by the contractor unless unique requirements dictate that the procuring activity specifies the identification number.

3.5 Mod Kit Documentation

The Mod Kit documentation includes the Mod Instructions, the Installation Notice Card (INC), and the validation requirements. This documentation, as described in the following paragraphs, shall be provided by the contractor for implementation by the using activity. Instructions for completing this documentation are found in Section 4.0 of this exhibit.

3.5.1 Mod Instructions

The Mod Instructions serve as a check list for kit completeness and instructions for accomplishing the modification. The Mod Instructions shall be developed by the contractor and shall be delivered with the Mod Kit.

3.5.2 Installation Notice Card

The INC provides a record of the installation and testing of the Mod Kit.

3.5.2.1 INC Submittals

The INC shall be initiated by the contractor developing the Mod Kit, delivered with the Mod Kit, and completed by the using activity. An INC shall be prepared for every modification approved for the CEI. A copy of the completed INC shall be sent to the appropriate MSFC CM office.

3.5.2.2 Types of INC's

When a modification to a CEI is covered by partial Mod Kits, an INC shall be prepared for each partial Mod Kit. A master INC shall be prepared for each modification for which partial kits have been shipped. The master INC shall be completed and distributed only upon installation and validation of all partial Mod Kits.

3.5.3 Mod Kit Validation Requirements

The contractor shall complete validation requirements for each Mod Kit and submit them with the Mod Kit. If there are no validation requirements, the Part I INC shall so indicate. (If validation requirements are not available at the time of Mod Kit shipment, the validation requirements shall be listed on DD FORM 250 as a shortage condition. When completed, the validation requirements shall be forwarded to the using site with a DD FORM 250 for inclusion in the Mod Kit.) Mod Kit shipment shall

not be withheld pending availability of the Mod Kit validation requirements.

3.6 Shipment of Mod Kits

All Mod Kits, including partials, shall be shipped by DD FORM 250. In addition to normal distribution requirements, a copy of each DD FORM 250 shall be forwarded to the appropriate MSFC CM office.

3.7 Partial Mod Kits

When partial Mod Kits are submitted, they shall be denoted as being "partials." When shipping a Mod Kit with shortages, all shortages shall be identified on the accompanying DD FORM 250. Each partial submittal shall include all instructions and engineering documentation required to accomplish the partial kit installation and validation. The first partial kit shall identify, to the extent possible, the total number of partial kits to follow. If partial Mod Kits were submitted, the final DD FORM 250 shall denote the final submittal and shall identify all partial DD FORM 250's to ensure complete tracking and accounting.

3.8 Mod Effectivity

If a mod effectivity involves multiple CEI serial numbers, the contractor shall prepare and ship one Mod Kit for each affected serial number. The only exception is when a Mod Kit shipped to a using site revises a standard field installation or operation. In this instance, the Mod Kit(s) shall be shipped for the CEI serial number(s) and shall include all appropriate documentation for revising the planned work. Modifications to subsequent affected serial numbers shall be accomplished at the site in accordance with the revised documentation. The last INC to be submitted for that modification shall indicate that it applies to the last serial-numbered item to be modified.

3.9 Changes to Mod Kits at a Using Site

All Mod Kit changes made subsequent to CCB approval shall require a revision symbol(i.e., R1, R2) to be suffixed to the Mod Kit number. To ensure accurate configuration accountability, the exact number, including revisions, shall be recorded on the INC of each kit installed. Additional requirements are stated in the following subparagraphs.

3.9.1 Prior to INC Buy-off

Minor make-fit changes completed prior to Part I INC buy-off by a NASA representative shall not require a revision to the authorizing ECP, unless the written technical content requires a change, additional site effort is required, or the condition from that previously approved is changed.

3.9.2 After INC Buy-off

All changes to Mod Kits after Part I INC buy-off shall require a revision to the authorizing ECP and submittal for CCB approval prior to incorporation.

3.9.3 Requirement for New INC

A new INC shall be required for revisions to Mod Kits when the authorizing ECP is revised and any of the following apply:

- a. Additional serial number CEI effectivities are authorized. An INC shall be completed for each additional Mod Kit authorized.
- b. The revised ECP authorizes a change in Mod Kits already installed and accepted by the using site.
- c. The revised ECP authorizes a change in Mod Kit requirements for a specific CEI serial number effectivity.

4.0 MOD KIT DOCUMENTATION COMPLETION INSTRUCTIONS

4.1 Mod Instructions Content

The mod instructions shall include the minimum information elements of Figure VII-1, Mod Instruction Outline, as explained in the following instructions:

<u>Item</u>	<u>Instructions</u>
-------------	---------------------

- | | |
|---|---|
| 1 | TITLE: - Concisely describe the change. |
| 2 | MOD INSTRUCTIONS NUMBER: - Assigned by the contractor developing the Mod Kit, using a combination of CEI number, ECP number, and serial number. The field shall be a maximum of 20 characters including suffix designation and revision code. |
| 3 | AUTHORIZATION: - Enter the number of the authorizing ECP and the MSFC PCN. |

- 4 DATE: - Enter the date the mod instruction was prepared.
- 5 MOD KIT PROOFED? - Answer "Yes" or "No." Include information on the type of testing or fit checks that were performed and the possible problems during Mod Kit installations, such as tolerance buildup, sequence criticality, etc.
- 6 WHERE WORK WILL BE ACCOMPLISHED: - Enter the location.
- 7 INSTALLATION SEQUENCE: - Enter the latest event in the work flow by which the Mod Kit must be installed.
- 8 SPARES AFFECTED? - Answer "Yes" or "No." For "Yes," list spares.
- 9 MANUALS AFFECTED? - Answer "Yes" or "No." For "Yes," list manuals.
- 10 SAFETY CONSIDERATIONS: - Specify any special safety precautions to be observed during modification work and validation.
- 11 PURPOSE OF MOD INSTRUCTION: - State clearly and concisely, including background information.
- 12 EFFECTIVITY: - List kit number against the applicable CEI part number and serial number.
- 13 PARTS/MATERIALS/DOCUMENTATION REQUIRED: - Detail the makeup of each Mod Kit, including common hardware, Mod Kit and installation drawings, validation requirements, and any other documentation required.
- 14 INSTRUCTIONS FOR ACCOMPLISHING MODIFICATION: - If complete instructions are contained in Block 13, so specify; otherwise, detail the instructions here.
- 15 NAMEPLATE: - Specify the data for the CEI's new nameplate and whether the nameplate is part of the kit or is to be made up at the work location.
- 16 SPECIAL PACKAGING/HANDLING INSTRUCTIONS: - List as applicable.
- 17 SPECIAL TOOLS, SAFETY EQUIPMENT OR TEST EQUIPMENT: - List as applicable.

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- 18 DISPOSITION OF REMOVED PARTS: - List parts, except expendables and small attaching hardware to be removed and the recommended disposition of each.
- 19 ESTIMATED MAN-HOURS REQUIRED: - Enter the contractor's estimate of the man-hours required to accomplish the modification.
- 20 VALIDATION REQUIREMENTS: - Define the requirements necessary to assure proper installation and proper CEI performance.
- 21 PREPARED BY: - Identify the contractor (organization and individual's name) preparing the mod instruction.
- 22 INSPECTED BY: - List the agent and agency inspecting the Mod Kit.

MOD INSTRUCTION

- 1 TITLE:
- 2 MOD INSTRUCTION NUMBER:
- 3 AUTHORIZATION:
- 4 DATE:
- 5 MOD KIT PROOFED?
- 6 WHERE WORK WILL BE ACCOMPLISHED:
- 7 INSTALLATION SEQUENCE:
- 8 SPARES AFFECTED?
- 9 MANUALS AFFECTED?
- 10 SAFETY CONSIDERATIONS:
- 11 PURPOSE OF MOD INSTRUCTION:
- 12 EFFECTIVITY:
- 13 PARTS/MATERIALS/DOCUMENTATION REQUIRED:
- 14 INSTRUCTIONS FOR ACCOMPLISHING MODIFICATION:
- 15 NAMEPLATE:
- 16 SPECIAL PACKAGING/HANDLING INSTRUCTIONS:
- 17 SPECIAL TOOLS, SAFETY EQUIPMENT, OR TEST EQUIPMENT:
- 18 DISPOSITION OF REMOVED PARTS:
- 19 ESTIMATED MAN-HOURS REQUIRED:
- 20 VALIDATION REQUIREMENTS:
- 21 PREPARED BY:
- 22 INSPECTED BY:

Figure VII-1. Mod Instruction Outline

4.2 Installation Notice Card Format and Instructions

Figure VII-2, Installation Notice Card, is a five-sheet no-carbon-required, perforated dual form. Completion and usage requirements are detailed in the following paragraphs.

4.2.1 Common Entries for Part I and Part II INC

<u>Block</u>	<u>Instructions</u>
1	CONTRACTOR NAME - Enter the name of the contractor providing the Mod Kit.
2	(XXXXXX) - Enter any desired internal tracking number.
3	PROGRAM CONTROL NO. - Enter the MSFC PCN assigned to the change.
4	CEI NO. - Enter the number of the CEI being modified.
5	CEI S/N - Enter the serial number of the CEI being modified.
6	ECP NO. - Enter the number of the ECP which established requirements for the modification. Include suffix designation and revision code.
7	NEW CEI PART NO. (IF CHANGED) - Enter the new part number when the modification will cause the part number to change.
8	MOD KIT NO. - Enter the number assigned to the Mod Kit to be installed in the CEI.

4.2.2 Completion of Part I - Mod Kit Installation

<u>Block</u>	<u>Instructions</u>
9	WORK LOCATION - Enter the location name where the modification is being accomplished.
10	WORK ORDER NO. - Enter the work order number assigned to the modification.
11	VALIDATION ACCOMPLISHED? - Enter "Yes" or "No" as applicable. A Part II INC is always required when "No" is indicated. If validation is not required, so note in the Remarks block of the Part I INC.

- 12 REMARKS: - Enter information as required. If additional space is required, a second or third INC may be used as continuation sheets.
- 13 INSTALLED BY-ORGANIZATION & DATE - To be completed and signed by the technician who accomplished the modification.
- 14 INSPECTED BY-ORGANIZATION & DATE - This block will be completed and signed by the inspector or maintenance supervisor who inspects the installation and finds it acceptable.
- 15 RECORDED BY-ORGANIZATION & DATE - The individual who records completion of the action signs and enters organization and date.
- 16 GOVERNMENT INSPECTION-ORGANIZATION & DATE - A NASA site representative signs this block to indicate NASA verification of work accomplished and that Part I of the INC is complete and correct.
- 17 DISTRIBUTION - Upon completion of Part I of the INC, make distribution as noted on the lower part of the card. If validation is required, tear off Part I and distribute while retaining Part II until completion of validation.

4.2.3 Completion of Part II - Mod Kit Validation

<u>Block</u>	<u>Instructions</u>
9	TEST LOCATION - Enter name of performing location of test.
10	TEST IDENTIFICATION - Enter the title, number and revision status of the test performed.
11	REMARKS - Enter remarks pertinent to successful accomplishment of the modification work and its validation.
12	TESTED BY-ORGANIZATION & DATE - The individual who accomplished the validation test signs and enters organization and date.
13	INSPECTED BY-ORGANIZATION & DATE - The inspector or maintenance supervisor who observes the test and finds the results acceptable signs and enters organization and date.

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- 14 RECORDED BY-ORGANIZATION & DATE - The individual who records completion of the action signs and enters organization and date.
- 15 GOVERNMENT INSPECTION-ORGANIZATION & DATE - A NASA site representative signs this block to verify accomplishment of validation requirements established in the Mod Kit.
- 16 DISTRIBUTION - Upon completion of Part II of the INC, make distribution as noted on the lower part of the card.

CONTRACTOR NAME (1)		INSTALLATION NOTICE CARD (XXXXXX) (2)		PROGRAM CONTROL NO. (3)	
PART II-MOD. KIT VALIDATION					
CEI NO. (4)		CEI S/N (5)		ECP NO. (6)	
NEW CEI PART NO. (IF CHANGED) (7)				MOD. KIT NO. (8)	
TEST LOCATION (9)				TEST IDENTIFICATION (10)	
REMARKS: (11)					
TESTED BY-ORGANIZATION & DATE (12)				INSPECTED BY-ORGANIZATION & DATE (13)	
RECORDED BY-ORGANIZATION & DATE (14)				GOVERNMENT INSPECTED-ORGANIZATION & DATE (15)	
(16) DISTRIBUTION	WHITE	GREEN	YELLOW	PINK	BUFF
	EQUIP. HISTORICAL RECORD	CEI PROVISIONING CONTRACTOR	TESTING CONTRACTOR	MSFC PROGRAM CMS	NASA SITE REP.

CONTRACTOR NAME (1)		INSTALLATION NOTICE CARD (XXXXXX) (2)		PROGRAM CONTROL NO. (3)	
PART I-MOD. KIT INSTALLATION					
CEI NO. (4)		CEI S/N (5)		ECP NO. (6)	
NEW CEI PART NO. (IF CHANGED) (7)				MOD. KIT NO. (8)	
WORK LOCATION (9)				WORK ORDER NO. (10)	
				VALIDATION ACCOMPLISHED <input type="checkbox"/> YES <input type="checkbox"/> NO (11) (IF NO - USING SITE MUST COMPLETE PART II)	
REMARKS: (12)					
INSTALLED BY - ORGANIZATION & DATE (13)				INSPECTED BY-ORGANIZATION & DATE (14)	
RECORDED BY - ORGANIZATION & DATE (15)				GOVERNMENT INSPECTION-ORGANIZATION & DATE (16)	
(17) DISTRIBUTION	WHITE	GREEN	YELLOW	PINK	BUFF
	EQUIP. HISTORICAL RECORD	CEI PROVISIONING CONTRACTOR	INSTALLING CONTRACTOR	MSFC PROGRAM CMB	NASA SITE REP.

Electronic facsimile

Figure VII-2. Installation Notice Card

4.3 Mod Kit Validation Requirements Instructions

Use the following instructions in preparation of the Mod Kit validation requirements. See Figure VII-3 for a sample format.

<u>Block</u>	<u>Instructions</u>
1	(CONTRACTOR NAME) - Enter the contractor name.
2	SHEET ____ OF ____ - Enter sheet number and total number of sheets.
3	CEI NO./CEI SERIAL NO. - Enter the CEI number and serial number of the CEI being modified.
4	ECP NO. - Enter the ECP number which established the requirements for the modification.
5	MOD. KIT NO. - Enter the number of the Mod Kit to which the validation requirements apply.
6	REQUIREMENTS DESCRIPTION - Enter the validation requirements defining the inspection and test requirements necessary to establish confidence in new system(s) added or to restore confidence of system(s) invalidated by incorporation of the Mod Kit. State whether or not the Mod Kit instructions reference existing test and inspection requirements/procedures.
7	CONTRACTOR ENGINEERING APPROVAL - ORGANIZATION & DATE - Preparing contractor representative signs and enters organization and date.

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1. (CONTRACTOR NAME)	MOD KIT VALIDATION REQUIREMENTS		2. SHEET ____ OF ____
3. CEI NO./CEI SERIAL NO.	4. ECP NO.	5. MOD. KIT NO.	
6. REQUIREMENTS DESCRIPTION			
7. CONTRACTOR ENGINEERING APPROVAL - ORGANIZATION & DATE			

Figure VII-3. Mod Kit Validation Requirements Format

EXHIBIT VIII

ENGINEERING RELEASE RECORDS

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EXHIBIT VIII

ENGINEERING RELEASE RECORDS

1.0 PURPOSE

This exhibit provides MSFC contractors with the minimum requirements for achieving proper control and relationships between identification elements in an engineering data file.

2.0 SCOPE

This exhibit establishes minimum requirements for and capabilities of the contractor's engineering release system pertaining to the following:

- a. Elements of data required.
- b. Production release functional capabilities.
- c. Release of engineering changes.
- d. Field release functional capabilities.

The requirements of this exhibit apply to all contractors preparing engineering drawings, software documentation/code, and specifications for hardware and software CEI's/CSCI's to the extent specified in the contract. This exhibit does not establish nor require the contractor to provide standardized formats for an engineering release system. The contractor shall assure compliance with these requirements by subcontractors, vendors, and suppliers.

3.0 REQUIREMENTS

3.1 General Requirements

The contractor shall prepare and maintain engineering release records in accordance with the minimum requirements of this exhibit. The contractor's formats, systems, and procedures may include information in addition to these minimum requirements, provided that the engineering release records conform to the following:

- a. They are limited to an expression of configuration requirements defined by engineering data.
- b. They do not reflect a hardware or other product condition that varies from the engineering requirements contained in the data.

c. They do not reflect manufacturing status.

The contractor shall maintain only one release record for each drawing number. The contractor shall not re-release drawings previously released by a subcontractor, vendor, supplier, or another contractor. Engineering release actions that result in the initial release of baseline engineering documentation shall cite the authority for that release (e.g., ECP, Configuration Control Board Directive (CCBD)).

3.2 Elements of Data Required for Hardware Items

The contractor's engineering release records for hardware items shall contain the following information.

3.2.1 CEI Elements

- a. Item number
- b. Item serial number(s) (Effectivity)
- c. Top drawing number
- d. Item specification identification number

3.2.2 Drawing Elements

- a. Drawing number
- b. Drawing title
- c. CAGE code
- d. Number of sheets
- e. Date of release
- f. Drawing change or revision letter and release date of authorizing document which directed the change or revision
- g. Ancillary document numbers; e.g., engineering change notices, engineering orders
- h. Specification document, specification control drawing, or source control drawing number

3.2.3 Part Number Elements

- a. Controlling drawing number
- b. Part numbers released
- c. Identification of change that created the part number

3.3 Elements of Data Required for Software Items

The contractor's engineering release records shall reference the software CSCI Version Description Document that contains all the required elements of data as specified in MM 8075.1 DRD STD/SW-VTP of the contract DPD.

3.4 Production Release Functional Capabilities

To the extent that the contractor has detailed design responsibility, the contractor's release function and documentation, including drawings and associated lists, shall be capable of determining these released engineering requirements:

- a. The composition of any part number at any level in terms of subordinate part numbers.
- b. All next higher or next assembly part numbers in which the part is used.
- c. The composition of any software CSCI in terms of components and units and subordinate item numbers.
- d. The CEI/CSCI number and serial numbers (effectivity) on which any subordinate part is used. This does not apply to subcontractors, vendors, and suppliers who are not producing CEI's/CSCI's.
- e. The Class I and Class II change identification numbers for engineering change packages that have been partially or completely released for any part number or CEI/CSCI number and serial number.
- f. The hardware CEI numbers and serial numbers or software CSCI and version numbers that constitute the effectivity of any change identification number.
- g. The subcontractor, vendor, or supplier part numbers which have been assigned in response to critical component (item) specification documents, specification control drawings, or source control drawings issued by the contractor.
- h. The contractor's specification document, specification control drawings, or source control drawing numbers associated with any subcontractor, vendor, or supplier part number.

3.5 Release of Engineering Changes

The contractor's release function and records shall be capable of identifying Class I and Class II engineering change packages. The contractor shall retain the record of superseded configuration requirements.

3.5.1 Release Records

Contractor release records shall identify all Class I and Class II engineering releases accomplished under the authority of each contractor CCB directive or equivalent. In addition, for all Class I changes, the ECP number shall be identified.

3.5.2 Release Change Packages

All Class I and Class II engineering change packages released for incorporation shall be completely released prior to formal acceptance of the deliverable unit.

3.5.3 Retention of Records

The configuration released for each CEI unit at the time of its formal acceptance shall be retained for the time specified by the record retention requirements in the contract.

3.6 Field Release Functional Capabilities

Engineering data defining equipment that is under the jurisdiction of the contractor or MSFC and is progressing through testing or through activation programs shall be maintained current with all field activity requirements and releases.

EXHIBIT IX
REVIEWS AND INSPECTIONS

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EXHIBIT IX

REVIEWS AND INSPECTIONS

1.0 PURPOSE

This exhibit provides guidance and requirements for CM participation in or conduct of various reviews and inspections.

2.0 SCOPE

This exhibit covers CM requirements to be implemented by MSFC contractors in the preparation, conduct, and closeout of various reviews and inspections. These requirements are applicable as specified in the contract.

3.0 REQUIREMENTS

MSFC reviews include design reviews, readiness reviews, and other reviews and inspections.

3.1 Design Reviews

The contractor shall support design reviews as specified in the contract SOW.

3.1.1 Descriptions

Design reviews that require contractor support are described as follows:

a. Program/Project Requirements Review

The Program/Project Requirements Review (PRR) is a design review of the mission objectives and program/project technical requirements. The PRR is conducted to ensure that the mission objectives and technical requirements are fully understood and to determine the adequacy of the contractor's efforts in defining system requirements.

b. Software Specification Review

The Software Specification Review (SSR) is a design review of the finalized software CSCI requirements and operational concept. The SSR is conducted to evaluate the contractor's responsiveness to and interpretation of the system or prime item level requirements. The SSR will determine that the software requirements specification, interface requirements specification, and operational concept

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form a satisfactory basis for proceeding into
preliminary software design.

c. Preliminary Design Review

The Preliminary Design Review (PDR) is a design review of the basic design approach for the CEI. The PDR is conducted to verify that the basic design is in compliance with the program/project requirements and provides assurance that the Part I CEI specification is suitable for approval.

d. Critical Design Review

The Critical Design Review (CDR) is a design review of the CEI design. The CDR is conducted to assure that the design agrees with the Part I CEI specification. The CDR verifies design completion and assures that the design is ready for release to manufacturing.

e. Software Test Readiness Review

The Software Test Readiness Review is a review conducted for each software CSCI to determine that the software test procedures are complete and that the contractor is prepared for formal software CSCI testing.

f. Design Certification Review

The objective of the Design Certification Review (DCR) is to assure that the CEI design and performance meets the requirements specification. The DCR is performed subsequent to the certification process (i.e., qualification testing, integration, system test analysis). The DCR places emphasis on satisfaction of performance requirements.

g. Configuration Inspection

The objective of the Configuration Inspection (CI) is to establish that the CEI configuration complies with the design documentation ("as-built" vs. "as-designed"). The CI establishes the Product Baseline which is defined by the Part II CEI specification(s) or equivalent.

h. Acceptance Review

The Acceptance Review (AR) is the final technical review conducted prior to product delivery and MSFC acceptance. This review consists of a detailed configuration review of all major CEI's/CSCI's of deliverable hardware and software, including flight

items, deliverable test articles, spares, special test equipment, support software, etc.

3.1.2 Contractor Support

The contractor shall accomplish the following effort to support design reviews as specified in the contract SOW:

- a. Examine the review documentation package to ensure compatibility with established review data plans or requirements. The review documentation package for the AR shall be an Acceptance Data Package (ADP) furnished by the contractor as detailed in Exhibit XI.
- b. Examine the submitted review documentation package to ensure that it reflects a uniquely identified record of all data items presented for review.
- c. Provide and maintain a system for recording, processing, tracking, and reporting the status of all Review Item Discrepancies (RID's) identified during the review.
- d. Provide support to process and track disposition of RID's.

3.1.3 Configuration Inspection Support

The contractor shall manage contractor effort for conducting CI's and shall assure attainment of objectives and compliance with detailed requirements described in paragraphs 3.1.3.1 through 3.1.3.3.

3.1.3.1 Configuration Inspection Objectives

A contractor shall participate in CI's to assure accomplishment of the following objectives:

- a. The configuration identification documentation is suitable for establishment of the Product Baseline at the end of development.
- b. The product specifications and associated drawings and software documentation are formally accepted as audited and approved documents that reflect the qualified configuration.
- c. The Product Baseline is established and forms a basis for processing and tracking changes.
- d. Released engineering documentation, including authorized deviations, waivers, and Material Review Board (MRB) actions, reflects the configuration of

the as-built and tested CEI's selected for inspection.

- e. The hardware that has been built is tested to the released engineering documentation.
- f. The physical configuration of the CEI unit selected for CI is compared with that unit's as-manufactured configuration documented by a technical data package proposed for release as the Product Baseline.
- g. The differences between the configuration specified in the CI technical data package and the as-manufactured configuration are identified and presented for review and reconciliation before establishment of the Product Baseline.
- h. The differences between the configuration of the CEI qualification unit and the CEI unit selected for the CI are identified.
- i. The validity of acceptance testing as specified in the Parts I and II CEI specifications is ensured by direct comparison of the test method/data with the CEI performance/design requirements to assure that the specifications are adequate to verify quality of the CEI.
- j. Any SCN's necessary to document changes to Parts I and II CEI specifications are prepared. The formal SCN is processed through normal configuration control procedures (see Exhibits II and V).
- k. The specifications and drawings (and/or computer presentations) of the CEI/CSCI are checked for continuity from top drawing down to piece-part documents.
- l. The validity of all computer software and media applicable to the Product Baseline is verified for format, completeness, and conformance to software requirement specifications.

3.1.3.2 Contractor Responsibilities

The contractor shall participate in each review as required by contract and shall comply with the following:

- a. Provide space, facilities, and support effort for conduct of CI's.

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- b. Coordinate with the responsible MSFC program/project manager and establish the time, place, representatives, and agenda for each review.
- c. Appoint a single contractor representative to be responsible for each CI review and identify this representative by name to the designated MSFC program/project chairperson. The representative shall have full decision-making capability and commitment authority.
- d. Ensure availability of designated CEI's and the associated documentation required for performance of the CI. The documentation shall include engineering drawings (and/or computer presentations), specifications, interface control documents, test procedures, software, and test data proposed for release as the Product Baseline. If required by contract, furnish preliminary documentation for review prior to CI.
- e. Provide identification listings of each item to be inspected including nomenclature, specification identification number, drawing and part numbers, item identification, serial numbers, and CAGE codes. Where applicable, document revision levels shall be included.
- f. Provide lists of all outstanding engineering changes that have been incorporated into the CEI and are awaiting incorporation into documentation.
- g. Provide a complete shortage list.
- h. Provide minutes of any DCR conducted for each CEI.
- i. Coordinate with the MSFC chairperson in the preparation and distribution of minutes for each CI. The minutes shall be of sufficient detail to ensure a clear understanding of each subject discussed and shall be made a matter of record. Participation in or acceptance of a report on a review by representatives of the procuring activity shall not be interpreted as approval of the design approach or acceptance of a CEI.
- j. Coordinate with the MSFC chairperson on the closeout of action items assigned to participants, in identifying the documentation establishing the baseline resulting from the review, and in initiating

CCB action for formal control of the product baseline.

3.1.3.3 Finalization of Configuration Inspections

Finalization of the CI shall include the following contractor actions:

- a. Based on the MSFC report summarizing the results of the CI and contract direction, the contractor shall resolve discrepancies and furnish any required SCN's to Parts I and II CEI specifications and associated drawings to the MSFC CCB for baselining.
- b. The contractor shall deliver an audited and validated documentation package of the Product Baseline as contractually specified.

3.2 Readiness Reviews

Contractor support shall be provided to the various Readiness Reviews conducted by engineering activities and project or program activities. These Readiness Reviews will be conducted at various levels of control to review the status and readiness of all elements associated with the project or program. Based on the result of incremental reviews, a top level NASA Flight Readiness Review (FRR) will be conducted to establish the readiness level of all engineering, operational, and support elements to accomplish and support a specific flight mission. Contractor support to the incremental and final FRR's shall include the following:

- a. Provide an accurate baseline configuration identification of the item(s) being reviewed.
- b. Provide an accurate identification of configuration differences between item(s) selected for the current mission and identical or similar item(s) used in previous missions.
- c. Provide a current status of all in-process changes affecting the item(s) under review.
- d. Provide configuration control support to ensure the expeditious and proper disposition of open changes, deviations and waivers.

3.3 Other Reviews and Inspections

Other reviews and inspections, including incremental reviews, may be performed during any phase of a program at the discretion of the responsible MSFC program/project

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manager. Other reviews and inspections may also be required in accordance with MSFC contract requirements. The contractor shall provide support as required by contract for the other reviews and inspections in a manner similar to that described for design reviews (see paragraph 3.1).

EXHIBIT X

CONFIGURATION VERIFICATION/VALIDATION

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EXHIBIT X

VERIFICATION/VALIDATION RECORDS

1.0 PURPOSE

This exhibit provides MSFC contractors with uniform practices pertaining to the configuration verification/validation process and the maintenance of records thereto. The purpose of verification/validation is to (1) verify and validate requirements; (2) provide assurance that requirements are properly documented; (3) make certain that design is compatible with requirements; and (4) assure that the product is compatible with the design. The configuration verification/validation process involves all elements of hardware, software/firmware, and integrated systems.

2.0 SCOPE

The configuration verification and validation process shall provide for total "as-built" documentation for acceptance of hardware and software/firmware including specifications, drawings, lists, release records, test procedures, acceptance procedures, and technical documents (including all engineering changes). Contractors shall be responsible for the compliance of their subcontractors, vendors, and suppliers.

3.0 REQUIREMENTS

The contractor's configuration verification/validation activity shall result in the establishment of a traceable process for the accomplishment of the following requirements:

- a. Assure that the released engineering design is in accordance with the established contractual design requirements.
- b. Assure that manufacturing planning is in accordance with the released engineering.
- c. Assure that material, component, and services acquisitions; fabrication; assembly; and testing are accomplished in accordance with the manufacturing planning.
- d. Assure that inspection certifications accurately reflect accomplishment of the manufacturing planning in the finished product.

Satisfaction of these requirements shall include activities stated in the following paragraphs.

3.1 Baseline Evolution and Accounting

Baseline verification is an ongoing process as the program matures and shall comply with the following:

- a. Progressive configuration verification shall be accomplished by using the incremental configuration identification baselines established by the formal reviews and inspections, (Exhibit IX), during the design and development phases.
- b. The products of each specific review or inspection shall ensure that requirements have been satisfied or that discrepancies have been identified and tracked through resolution. As engineering changes are authorized, verification shall be made to assure that the changes have been correctly implemented and tested.

3.2 Engineering Change and Deviation/Waiver Incorporation

Each approved engineering change and DAR shall be incorporated in all authorized units of the CEI's. Verification and validation of the incorporation shall ensure that mod kits and spares are ordered and shipped to the proper location. The requirements of this exhibit are based on engineering, manufacturing, and quality control capabilities that the contractor must possess to satisfy contractual requirements and accomplish the following:

- a. Reconcile work authorizations to contract requirements.
- b. Verify that released engineering and purchase order data are in accordance with contract requirements.
- c. Ensure that engineering change documentation references the change number under which the change was authorized and that the changes are manufactured and installed for the approved effectivity.
- d. Provide a clear audit trail from engineering change authorization to completion of all actions required by the change packages.
- e. Provide a record of differences between engineering documentation and delivered hardware/software including DAR's and outstanding FEC's.

- f. Following the CI and baselining of the CEI Part II specification, provide a record of the differences between the documentation called out in the CEI Part II specifications and the delivered CEI. All differences which are classified as Class II changes shall be so designated. All other differences shall cite the authorizing ECP or DAR.

3.3 Configuration Verification/Validation Requirements

The contractor shall ensure that configuration baselines and subsequent engineering changes thereto properly identify and control the design, manufacture, and modification of CEI hardware and software in accordance with contract requirements. Configuration verification and validation shall assure the following:

- a. A clear closed-loop audit trail exists in both directions between authorization and accomplishment.
- b. The effectivities specified in engineering data of engineering changes are compatible with contractual authorization.
- c. The engineering release includes the release of specification replacement pages resulting from any SCN approved with the engineering change.
- d. No qualification requirements are established or changed unless specifically authorized by the contract.
- e. Changes in acceptance test requirements are converted to procedures, and these procedures are within the specifications and schedules authorized by the contract.
- f. Vendor purchase orders and change notices are in accordance with specifications and schedules authorized by the contract.
- g. Manufacturing requirements are in accordance with the specifications and schedules authorized by the contract.

3.4 Manufacturing Configuration Verification/Validation

The contractor shall verify that all hardware CEI's and verify and validate that all software/firmware CSCI's are manufactured in accordance with released engineering data by ensuring the following:

- a. Part numbers are not changed except as required by formally released data that identifies a non-interchangeable condition.
- b. Synthetic numbers/codes are marked "Manufacturing Designation Only" (or equivalent) and are removed before acceptance of equipment by MSFC.
- c. Material controls verify that any change required as a result of a Class I engineering change has been incorporated into specific vendor item(s).
- d. Manufacturing controls identify the specific engineering changes incorporated in specific parts/subassemblies.
- e. Manufacturing controls properly route vendor items and subassemblies containing engineering changes to the appropriate CEI's.

3.5 Inspection, Audit, and Surveillance

The contractor shall:

- a. Audit manufacturing orders and assure that the manufacturing and product assurance documentation used by the contractor is auditable and in accord with released engineering data.
- b. Inspect material control, manufacturing and process control, and assembly operations and verify that each change is completely incorporated in the CEI unit for which it first applies, or that any missing part of the change is listed as a shortage.
- c. Establish that standard procedures and controls provide for subsequent incorporation of each change in accordance with released engineering or will identify shortages.
- d. Maintain surveillance to assure continual incorporation and documentation of changes as specified.

3.6 Documenting Engineering Change Incorporation

Change incorporation records shall be maintained and shall include the following:

- a. Identification of the engineering change as a package so that installation of the complete engineering change into a CEI can be verified.
- b. An inspector's acceptance file (e.g., shop travelers, receiving reports, automated tracking system reports) showing the manufactured part and serial numbers on the CEI where each engineering change is incorporated.
- c. A record for each CEI in which an engineering change is incorporated that shows installations of required subassemblies by part and serial number.
- d. A break of inspection (BOI) record for each CEI unit to document any modifications resulting from removals and replacements after the initial installation has been accepted by the inspector.
- e. A record of FEC's pending incorporation into hardware/software/firmware and documentation for each CEI/CSCI.
- f. A record of Class II changes with a description of the engineering change for each CEI.

3.7 System Acceptance

The contractor shall provide the following:

- a. Documentation sufficient to verify compatibility of the CEI with program/project requirements and to establish compatibility of the CEI with interfacing items and integrated systems.
- b. An ADP developed in accordance with Exhibit XI which identifies all equipment, facilities, spares, technical documents, software/firmware, and engineering data comprising the delivered CEI/CSCI.

EXHIBIT XI

ACCEPTANCE DATA PACKAGE

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EXHIBIT XI

ACCEPTANCE DATA PACKAGE

1.0 PURPOSE

This exhibit provides guidance and requirements for the content of each Acceptance Data Package (ADP) provided at the time of acceptance of each CEI.

2.0 SCOPE

This requirement is applicable to all MSFC contracts which require delivery of CEI's and supporting acceptance documentation.

3.0 REQUIREMENTS

3.1 Acceptance Data Package Submission

The ADP shall be submitted in accordance with contractual data delivery requirements. The ADP shall clearly identify the configuration of the CEI being delivered, any differences from baselined requirements, and any effort or deliveries that must be accomplished after acceptance to fulfill contract requirements.

3.2 Acceptance Data Package Contents

3.2.1 Table of Contents

The table of contents is a tabular listing which identifies and locates the major items contained in the ADP.

3.2.2 CEI Log Books

Log books shall be current to the time of acceptance by MSFC; the following appropriate categories shall be included in the log book:

- a. Running/operating time and cycle log(s) for each time and cycle critical item of the CEI. These logs shall identify the item(s) by nomenclature, part number and serial number and shall state the total authorized life and the life expended.
- b. Test history log, including post manufacturing checkout and final verification tests of the CEI, with the following data:
 - (1) Actual measurements identified to specified tests. References to applicable test reports

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are satisfactory, provided that copies of the reports are included.

- (2) Brief test summary.
 - (3) List of unaccomplished tests or portions of tests with estimated man-hours required for completion.
 - (4) List of actual and recommended retest(s) including status.
 - (5) Special test instructions, investigations, warnings, and problems encountered during factory testing.
 - (6) Failure and corrective action data for all functional failures during the post manufacturing and final acceptance test and checkout of the CEI.
- c. Inspection records for all inspections performed, such as packaging, presentation, trouble shooting, removals and replacements, shortages preventive maintenance, etc.
 - d. Transfer records providing a history of all CEI movement until time of transfer to the procuring agent.
 - e. Alignment data records for the total CEI and all alignment critical components (items).
 - f. Component (including Government-Furnished Property) log books.
 - g. Weight and balance logs covering total weight and horizontal, vertical, and lateral center of gravity.

3.2.3 Configuration Records

- a. Parts and drawing lists identifying all parts and drawings that are changed from baseline configuration.
- b. Software configuration records defining the verified and validated software including the Version Description Document, Software Certification, and the validated software program.
- c. A list of authorized deviations and waivers.

- d. A complete list of hardware and software/firmware items shipped loose or separately. This list shall cover all items needed to complete the CEI/CSCI or satisfy programmed work and shall include scheduled dates of arrival.

3.2.4 Certifications

A copy of the proposed DD Form 250, Material Inspection and Receiving Report, or equivalent. The document shall identify the CEI by model number, serial number, part number and the governing CEI specification.

EXHIBIT XII

DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

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EXHIBIT XII

DEFINITIONS, ABBREVIATIONS, AND ACRONYMS

1.0 PURPOSE

This exhibit provides standardized definitions and explanations of the words, terms, phrases, abbreviations, and acronyms that characterize the terminology used in CM implementing instructions.

2.0 SCOPE

This exhibit is applicable to MSFC contractors who are providing design, development, fabrication services, or products for MSFC-managed program or project activities.

3.0 DEFINITIONS

3.1 Acceptance Data Package (ADP)

Complete documentation necessary to clearly identify the configuration of the Contract End Item (CEI) being accepted, including test and operating logs, any differences from contract requirements, and any work that must be expended after acceptance in order to fulfill contract requirements.

3.2 Acceptance Review (AR)

The review conducted to ensure that all aspects of manufacturing, qualification, verification/validation, acceptance testing, and documentation are satisfactory for product delivery and MSFC acceptance.

3.3 Baseline

The technical requirements of a program/project/CEI as approved by the responsible CCB at a specific time during its life cycle and recorded in a configuration identification document or set of documents and changes thereto. There are three basic baselines as indicated below.

a. Mission Baseline

The technical requirements as recorded in the initial approved program/project (system) specification or other requirements documents. This baseline is established as a product of the Program/Project Requirements Review (PRR) and is similar to the DOD functional baseline as defined in MIL-STD-973.

b. Design Requirements Baseline

The technical requirements as recorded in the initial approved part I CEI detail specifications. This baseline is established as a product of the Preliminary Design Review (PDR) and is similar to the DOD allocated baseline as defined in MIL-STD-973.

c. Product Baseline

The technical requirements as recorded in the initial approved part II CEI detailed specification and subordinate approved detail specifications and drawings. This baseline is finalized as a product of the Configuration Inspection (CI) and is similar to the DOD product baseline as defined in MIL-STD-973.

3.4 Baseline Design Review

A review conducted at that point in the progress of a specific program when it is required to establish and define the requirements (design, development, production, etc.) of a system, equipment, or facility and to have a point of departure for control and maintenance of changes.

3.5 Commercial and Government Entity (CAGE) Code

A five-character code listed in Cataloging Handbook H4/H8 which is assigned to commercial and Government activities that manufacture or develop items, or provide services or supplies for the Government. When used with a drawing number or part number, the CAGE code designates the design activity to which the drawing or part number is assigned. The CAGE Code was previously called manufacturer's code, code identification number, or Federal Supply Code for Manufacturers (FSCM).

3.6 Component

A combination of parts, devices, and structures, usually self-contained, which performs a distinctive function in the operation of the overall equipment.

3.7 Computer Software Configuration Item (CSCI)

An aggregation of software that satisfied an end use function and is designated by the Government for separate configuration management. CSCI is used synonymously with CEI.

3.8 Configuration

The functional and physical characteristics of existing or planned hardware, firmware, software, or a combination thereof, as set forth in technical documentation and ultimately achieved in a product.

3.9 Configuration Accounting

The recording and reporting of the information that is needed to manage configuration effectively, including a listing of the approved configuration identification, the status of proposed changes, deviations and waivers to configuration, and the implementation status of approved changes.

3.10 Configuration Control

The systematic definition, evaluation, coordination, and disposition of each proposed change, deviation or waiver, and the implementation of each approved change in the configuration of a program/project/CEI after formal establishment of the configuration identification.

3.11 Configuration Control Board (CCB)

The functional body responsible for establishing baselines and the reviewing and dispositioning of all changes, deviations or waivers to these baselines.

3.12 Configuration Control Board Directive (CCBD)

The document used to record the actions of a CCB to establish baselines, disposition changes to baselines, and authorize deviations/waivers to baselines. The document specifies each action, actionee, and due date required to implement the change. The form contains a signature block for the concurrence or nonconcurrence of each board member and the authorization of the CCB chairman.

3.13 Configuration Identification

The establishment of approved technical documentation defining the approved configuration of a program/project/CEI throughout its life cycle and its maintenance on a current basis. This documentation consists of specifications, drawings and associated lists, including documents referenced therein and approved changes thereto.

3.14 Configuration Identification Numbers

Numbers that, individually or in combination, permit accurate selection of the configuration required to perform a given function. These numbers may include: (a) specification identification numbers, (b) CEI/CSCI numbers, (c) drawing and part numbers, (d) engineering change identification numbers, (e) Commercial and Government Entity (CAGE) code numbers, (f) serial numbers, and (g) lot numbers.

3.15 Configuration Inspection (CI)

A formal review that is used to establish the Product Baseline and to verify that the contract end items have been, and other like items can be, manufactured, tested, etc., to the released engineering documentation. This is accomplished by a comparison of the "as-built" configuration to the "as-designed" requirements. The CI is a one-time review conducted for each family of CEI's.

3.16 Configuration Management (CM)

A discipline applying technical and administrative direction and surveillance to accomplish the following tasks:

- a. Identify and baseline the technical requirements of programs/projects/CEI's.
- b. Control changes, deviations, and waivers to these technical requirements.
- c. Record and report change processing and implementation status.
- d. Account for approved changes and their incorporation into programs/projects/CEI's.
- e. Verify that the configuration of systems and CEI's is as specified in configuration identification documentation.

3.17 Configuration Verification

The task of ensuring that the program hardware, software, and firmware is certified as having been designed, built, and tested to the correct configuration baseline.

3.18 Contract End Item (CEI)

An aggregation of hardware/software/firmware defined by a specification and designated by MSFC as requiring the CM discipline. CEI is used synonymously with CSCI.

3.19 Contractor

An entity (e.g., individual, partnership, company, corporation, association) having a product or services contract with a procuring activity.

3.20 Critical Design Review (CDR)

A technical review of the detailed design of the selected configuration. This review is generally held when the design is approximately 90 to 95 percent complete and provides assurance that the detail design is in accordance with the Part I CEI specification prior to engineering release to manufacturing.

3.21 Critical Component

See Critical Item

3.22 Critical Component List

See Critical Item List

3.23 Critical Item

a. Engineering - A critical item is engineering critical where one or more of the following applies:

- (1) The technical complexity warrants an individual specification.
- (2) Reliability of the critical item significantly affects the ability of the system or prime item to perform its overall function, or safety is a consideration.
- (3) The prime item cannot be adequately evaluated without separate evaluation and application suitability testing of the critical item.

b. Logistics - A critical item is logistics critical where the following apply:

- (1) Repair parts will be provisioned for the item.
- (2) The contracting agency has designated the item for multiple source procurement.

- c. Safety - A critical item is safety critical when it is a single failure point and/or an item in a life or mission essential operation.

3.24 Critical Item List (CIL)

A list of safety critical items prepared from the Failure Modes and Effects Analysis (FMEA) of all single-failure points and critical redundant items that cannot be eliminated from the system. The list includes the rationale for retention of each item on the list.

3.25 Data Element (Software/Firmware)

A single piece of information, the smallest unit normally residing in a computer system (database). A record consists of one or more data elements.

3.26 Design Certification Review (DCR)

A technical review conducted to evaluate the results and status of verification (inspection, testing, and/or analysis) to certify that the CEI design and performance meet the specification requirements.

3.27 Design Requirements Baseline

See Baseline.

3.28 Deviation

A specific written authorization, granted prior to the manufacture of an item, to depart from a particular requirement(s) of an item's current approved configuration documentation for a specific number of units or a specified period of time. (A deviation differs from an engineering change in that an approved engineering change requires corresponding revision of the item's current approved configuration documentation, whereas a deviation does not.)

3.29 Deviation/Waiver Approval Request (DAR)

A form used to define and request approval of deviations and waivers.

3.30 Document Change Instruction (DCI)

See Specification Change Instruction (SCI)

3.31 Document Change Notice (DCN)

See Specification Change Notice (SCN)

3.32 Drawing (Engineering)

An engineering document or digital data file(s) that discloses (directly or by reference), by means of graphic or textual presentations, or combinations of both, the physical and functional requirements of an item.

3.33 Effectivity

The specific hardware or software family and serial number(s), specific missions, or specific period of time to which part numbers, changes, deviations, waivers, etc., are identified.

3.34 Engineering Change Proposal (ECP)

A proposed engineering change and the documentation by which the change is described, justified, and submitted to the Government for approval or disapproval.

3.35 Engineering Release Record

The single, authoritative data file identifying released documentation and changes thereto.

3.36 Engineering Release System

The single, authoritative control system for assigning document numbers, verifying requirements, recording and transmitting engineering documentation required for fabrication, assembly, installation, and test of program hardware/software.

3.37 Facility

Any fixed installation, e.g., test stand or launch mechanism, which is part of a program/project. This includes real property and installed equipment.

3.38 Failure Modes and Effects Analysis (FMEA)

A study of a system and working interrelationships of its elements to determine ways in which failures can occur (failure modes) and the effects of each potential failure on the system element in which it occurs, on other system elements, and on the success of the system's mission.

3.39 Field Engineering Change (FEC)

The method for proposing emergency/urgent engineering changes at NASA using sites on equipment for which MSFC retains design responsibility and for which time is not adequate for preparation and processing of an ECP.

3.40 Firmware

The combination of a hardware device and computer instructions or computer data that resides as read-only software on the hardware device. The software cannot be readily modified under program control.

3.41 Flight Readiness Review (FRR)

A detailed review by which the system will be certified as flightworthy. The FRR includes review of the system verification process (both testing and analysis), system compatibility, operational planning, and team preparedness. The review will result in certification of flight readiness of the operational team, the acceptability of the vehicle for each flight, and the readiness of the system to achieve all flight objectives.

3.42 Installation Notice Card (INC)

The official document used after contract delivery to update the configuration management system and to inform the procuring activity and the contractor that a particular modification package has been installed, tested, verified, and accepted in accordance with its associated change instruction.

3.43 Interface

A region common to two or more elements, systems, projects, or programs characterized by mutual physical, functional, and procedural properties.

3.44 Interface Control Drawing/Document (ICD)

Documentation in the form of drawings and/or written record that identifies the requirements that define and depict the physical, functional, and procedural interfaces that must be met by separate developing contractors and/or agencies.

3.45 ICD Contractual Index and Status Report

A summary compilation of contractual ICD's with related revisions, IRN's, and effectivities.

3.46 Interface Requirements Document (IRD)

A top level document that identifies and provides mutually agreeable interface requirements between different programs or projects and specifies basic requirements for allocation and quantification to lower level ICD's and/or interfacing specifications.

3.47 Interface Revision Notice (IRN)

A form used to record approved changes to baselined interface documents.

3.48 Material Review Board (MRB)

A board consisting of representatives of organizations necessary to review, evaluate, and determine or recommend disposition of nonconforming items that have been referred to the board.

3.49 Mission Baseline

See Baseline.

3.50 Modification Instruction (Mod Instruction)

A form initiated by the designer to be used as a checklist for mod kit completeness and to serve as instructions for accomplishing the modification.

3.51 Modification Kit (Mod Kit)

A package containing necessary documentation, hardware, software, and Mod Instructions to incorporate an approved engineering change in Government-accepted or in-service articles.

3.52 Mod Kit Validation Requirements

Information provided with a Mod Kit which defines inspection and test requirements necessary to establish confidence in new system(s) added or to restore confidence of system(s) invalidated by incorporation of a Mod Kit.

3.53 Preliminary Design Review (PDR)

One of the major baseline design reviews in which the CEI manager ensures the system compatibility of the design approach for the CEI and determines acceptability of the

Part I CEI specification for establishment of the Design Requirements Baseline.

3.54 Preliminary Interface Revision Notice (PIRN)

An IRN form used to describe proposed changes to IRD's/ICD's by participating contractors or design agencies.

3.55 Prime Contractor

A contractor who performs or manages the overall performance of the design, development, manufacture, launch, or maintenance of a CEI or CEI's under the terms of a contract.

3.56 Prime Equipment

A complex item, e.g. External Tank, Main Engine, etc., that is normally produced and accepted on a Form DD 250. Quality inspection and test of each item, as opposed to sampling, is required.

3.57 Prime Item

See Prime Equipment.

3.58 Product Baseline

See Baseline.

3.59 Program Control Number (PCN)

A unique number assigned to the first item of a change package which initiates a particular engineering change. The same number is assigned to all subsequent actions and documentation associated with that engineering change which, together with the initial engineering change document, is recognized as a change package. This same concept applies to program control identification numbers, space station control numbers, and any other name that may be applied to a number used for this purpose.

3.60 Program/Project Requirements Review (PRR)

The first of the major baseline design reviews in which the program/project manager ensures that the mission objectives and the project/system specification technical

requirements are fully understood and are acceptable for establishment of the Mission Baseline.

3.61 Project Change Proposal (PCP)

A form used by a contractor to propose a non-engineering change to contract requirements, such as Type I documents, schedules, SOW's, etc.

3.62 Review Item Discrepancy (RID)

The form used during a formal review to (1) identify and record discrepancies in requirements, plans, and designs, and (2) specify the approved corrective action and actionee.

3.63 Software

A combination of associated computer instructions and computer data definitions required to enable the computer hardware to perform computational or control functions.

3.64 Software Version Description Document (VDD)

A specification documenting the exact "as-built" configuration of software to be delivered.

3.65 Specification

A document prepared specifically to support acquisition which clearly and accurately defines performance, design, and verification requirements.

3.66 Specification Change Instruction (SCI)

A document that records all SCN's issued against a specification, provides a chronological listing of all changes to the specification, and provides the replacement page deletion/insertion instructions. A Document Change Instruction (DCI) performs the same functions for non-specification contractual documents.

3.67 Specification Change Notice (SCN)

A form used to propose, transmit, and record changes to a baselined specification. A Document Change Notice (DCN)

performs the same functions for non-specification contractual documents.

3.68 Statement of Work (SOW)

A document that accurately describes the requirements for contracts providing items, materials, or services including the standards used to determine whether requirements have been met.

3.69 Subcontractor

A contractor who provides an item and/or service under the terms of a contract with a prime contractor.

3.70 Supplier

A source from whom a purchased item is obtained; used synonymously with the term vendor.

3.71 System

A composite of equipment, skills, and techniques capable of performing and/or supporting an operational role. A complete system includes all equipment, related facilities, material, software, services, and personnel required for its operation and support to the degree that it can be considered a self-sufficient item in its intended operational environment.

3.72 Vendor

See Supplier.

3.73 Verification/Validation

The inspection and tests necessary to establish confidence in a new system, to restore confidence in an added system, or to restore confidence in a system invalidated by the installation of a modification into a CEI.

3.74 Waiver

A written authorization to accept an item, which during manufacture, or after having been submitted for Government inspection or acceptance, is found to depart from specified requirements, but nevertheless is considered suitable for use "as is" or after repair by an approved method.

4.0 ABBREVIATIONS AND ACRONYMS

ACI	Allocated Configuration Identification
ADP	Acceptance Data Package
AR	Acceptance Review
Assy	Assembly
BOI	Break of Inspection
CAGE Code	Commercial and Government Entity (Code)
CCB	Configuration Control Board
CCBD	Configuration Control Board Directive
CDR	Critical Design Review
CEI	Contract End Item
CI	Configuration Inspection
CIL	Critical Items List
CM	Configuration Management
CSCI	Computer Software Configuration Item
DAR	Deviation/Waiver Approval Request
DCI	Document Change Instruction
DCN	Document Change Notice
DCR	Design Certification Review
DOD	Department of Defense
ECP	Engineering Change Proposal
EO	Engineering Order
FEC	Field Engineering Change
FMEA	Failure Mode and Effects Analysis
FRR	Flight Readiness Review

FSCM	Federal Supply Code for Manufacturers (superseded by CAGE CODE)
GFP	Government Furnished Property
GSE	Ground Support Equipment
I&C	Installation and Checkout
ICD	Interface Control Document
INC	Installation Notice Card
IRD	Interface Requirement Document
IRN	Interface Revision Notice
MAF	Michoud Assembly Facility
Mfg.	Manufacturing
Mod.	Modification
MRB	Material Review Board
NHA	Next Higher Assembly
No.	Number
PCI	Product Configuration Identification
PCN	Program Control Number
PCP	Project Change Proposal
PDR	Preliminary Design Review
PIRN	Preliminary Interface Revision Notice
PRR	Program/Project Requirements Review
R or Rev	Revision
RDS	Reliability Data Summary
RID	Review Item Discrepancy
SCI	Specification Change Instruction
SCN	Specification Change Notice
SIRS	Software Interface Requirements Specification

SN	Serial Number
SOW	Statement of Work
SRS	Software Requirements Specification
SSR	Software Specification Review